MANUAL No. 17

Blue Ribbon Service Training Course

SERVICEMAN'S GUIDE

Farmalls-M, MD and 6 Series Tractors, Crawler Tractors and Power Units

INTERNATIONAL HARVESTER COMPANY
180 NORTH MICHIGAN AVE. CHICAGO 1, ILLINOIS

INTRODUCTION

This is one of a series of special instruction manuals designed to assist in "On-The-Job-Training" of servicemen. These manuals are a source of up-to-date service information for Blue Ribbon Servicemen, giving recommended procedures for servicing International Harvester equipment. Specifications, adjustments and other data included in this manual are designed to serve as a valuable addition to the dealer's service library. Salesmen also will find information in these manuals that will assist in the presentation of outstanding features of construction and materials used in IH products.

The machines described in this manual are the Farmalls M, MD, MV, and MDV; the W-6 and WD-6 standard tractors; the O-6, OS-6 and ODS-6 orchard and grove tractors; the I-6 and ID-6 industrial wheel tractors; the T-6 and TD-6 crawler tractors; the U-6 and UD-6 power units; and the IU-6 and IUD-6 tractor-engine-over-axle units.

These machines have been assembled for description in a single manual because of the many features of construction they have in common. Two types of engines are used in this group of machines, carbureted and Diesel. Units having Diesel engines are identified by the letter "D" in the model symbol, as Farmall MD, WD-6, etc. Engines of both types are valve-in-head, four-cylinder, having $3\frac{7}{8}$-inch bore and $5\frac{1}{4}$-inch stroke, and are approximately the same horsepower. All carbureted engines have the same type of fuel and ignition systems. All Diesel engines have similar fuel injection and starting systems. Clutch, transmission, differential and final drive as well as belt pulley and power take-off, are very similar on all wheel type tractors of this series.

INDEX

CARBURETED ENGINES

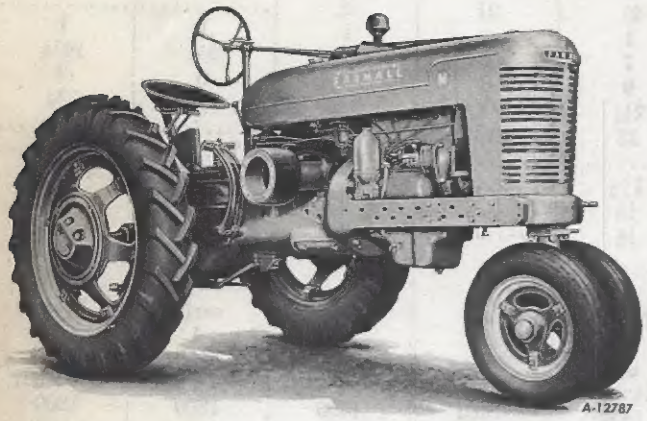
DIESEL ENGINES

Models	M	MV	MD	MDV	W-6	WD-6	T-6
Approx. capacities (U.S. measure)							
Fuel tank, gallons	21	21	21	21	21	21	20
Starting fuel tank (when used), gallons	1	1	1	1	1	1	1
Water, cooling system, gallons	6	6	7	7	6	7	9½
Oil, crankcase pan, quarts	8	8	9	9	8	9	9
Oil, air cleaner cup, pints	2¼	2¼	2¼	2¼	2¼	2¼	2¾
Transmission and differential case, gallons	13	13	13	13	13	13	4
Final drive case, each side, pints	.....	7	.....	7	.....	.....	2
Steering gear case, pints	1	1	1	1	1½	1½	.....
Diesel injection pump case, Bosch, pints	.....	.....	⅜	⅜	.....	⅜	.....
Diesel injection pump case, IH, pints	.....	.....	½	½	.....	½	.....
Engine,							
Carbureted or Diesel, type	carb.	carb.	Diesel	Diesel	carb.	Diesel	carb.
Cylinders, number	4	4	4	4	4	4	4
Cylinder sleeve, type	dry	dry	dry	dry	dry	dry	dry
Bore and stroke, inches	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼
Governed speed, maximum load, rpm	1450	1450	1450	1450	1450	1450	1450
Magneto IH-H-4 fixed spark, rotation	c.w.	c.w.	c.c.w.	c.c.w.	c.w.	c.c.w.	c.w.
Spark plug, thread size	18mm.	18mm.	⅞—18t.	⅞—18t.	18mm.	⅞—18t.	18mm.
Spark plug gap, inches	.028 to .032	.028 to .032	.020 to .025	.020 to .025	.028 to .032	.020 to .025	.028 to .032
Valve clearance, engine hot, inches	.017	.017	.017	.017	.017	.017	.017
Carburetor (up draft), inches	1¼	1¼	starting only	starting only	1¼	starting only	1¼
Clutch							
Engine, dry disk, type	spg.-loaded	spg.-loaded	spg.-loaded	spg.-loaded	spg.-loaded	spg.-loaded	overcenter
Size, inches	11	11	11	11	11	11	12
Transmission, speeds							
Based on pneumatic tire (rear), size	12.00–38	10.00x36	12.00–38	10.00x36	13.00–30	13.00–30	.....
Speed in m.p.h. 1st	2⅝	2½	2⅝	2½	2⅜	2⅜	1½
Speed in m.p.h. 2nd	3½	3⅜	3½	3⅜	3⅜	3⅜	2¼
Speed in m.p.h. 3rd	4⅜	4⅛	4⅜	4⅛	4½	4½	3⅛
Speed in m.p.h. 4th	5¼	5	5¼	5	5⅜	5⅜	3⅞
Speed in m.p.h. 5th	16¾	16	16¾	16	16	16	5⅜
Speed in m.p.h. Reverse	3¼	3	3¼	3	2⅞	2⅞	1¾
Belt pulley attachment							
Pulley speed gov. full load, rpm	899	899	899	899	899	899	811
Belt speed, 11-in. pulley, feet per minute	2587	2587	2587	2587	2587	2587	2335
Power take-off attachment							
Shaft speed gov. full load, rpm	537	537	537	537	537	537	540 or 862
Spline diameter std. hitch, inches	1⅜	1⅜	1⅜	1⅜	1⅜	1⅜	1⅜
Wheels and tread							
Front wheels, toe-in, inches	.....	½	.....	½	⅜	⅜	.....
Front wheel tread, inches	9⅛	60—66	9⅛	60—66	46¾	46¾	.....
Rear wheel tread, inches	52 to 88	60 to 72	52 to 88	60 to 72	53	53	.....
Wheel base, inches	88½	91 7/16	90	93	76	76	.....
Crawler tractor, ground contact length, inches	.....	.....	.....	.....	.....	.....	.....
Tread, narrow, inches	.....	.....	.....	.....	.....	.....	58⅝
Tread, wide, inches	.....	.....	.....	.....	.....	.....	40
Track shoe widths, for narrow tread, inches	.....	.....	.....	.....	.....	.....	50
Track shoe widths, for wide tread, inches	.....	.....	.....	.....	.....	.....	8 to 12
Brakes							8 to 20
External-contracting on drums (foot operated) diameter, inches	11½	11½	11½	11½	11½	11½	12⅛
Drawbar							
Type	bar	bar	bar	bar	bar	bar	bar
Vertical adjustment from ground, inches	12 to 18	15 to 21	12 to 18	15 to 21	7⅞ to 17¼	7⅞ to 17¼	12¼ fixed
Lateral hitch position each side of center, inches	13	15	13	15	7¼	7¼	.....
Lateral movement, swinging drawbar attachment, each side of center, inches	15¾	.....	15¾	.....	14	14	9½

CIFICATIONS

TD-6	O-6	OS-6	ODS-6	I-6	ID-6	IU-6	IUD-6	U-6	UD-6
20	21	21	21	21	21	21	21	.....	.....
1	1	1	1	1	1	1	1	1	1
10½	6	6	7	6	7	6	7	9½	10½
9	8	8	9	8	9	8	9	8	9
2¾	2¼	2¼	2¼	2¼	2¼	2¼	2¼	2¾	2¾
4	13	13	13	13	13	13	13	.....	.....
2	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	1½	1½	1½	1½	1½	.....	.....	.....	.....
⅜	.....	.....	⅜	.....	⅜	.....	⅜	.....	⅜
½	.....	.....	½	.....	½	.....	½	.....	½
Diesel	carb.	carb.	Diesel	carb.	Diesel	carb.	Diesel	carb.	Diesel
4	4	4	4	4	4	4	4	4	4
dry	dry	dry	dry	dry	dry	dry	dry	dry	dry
3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼	3⅞ x 5¼
1450	1450	1450	1450	1450	1450	1450	1450	1500	1500
c.c.w.	c.w.	c.w.	c.c.w.	c.w.	c.c.w.	c.w.	c.c.w.	c.w.	c.c.w.
⅞—18t.	18mm.	18mm.	⅞—18t.	18mm.	⅞—18t.	18mm.	⅞—18t.	18mm.	⅞—18t.
.020 to .025	.028 to .032	.028 to .032	.020 to .025	.028 to .032	.020 to .025	.028 to .032	.020 to .025	.028 to .032	.020 to .025
.017	.017	.017	.017	.017	.017	.017	.017	.017	.017
starting-only	1¼	1¼	starting-only	1¼	starting-only	1¼	starting-only	1¼	starting-only
overcenter	overcenter	overcenter	overcenter	spg.-loaded	spg.-loaded	spg.-loaded	spg.-loaded	overcenter	overcenter
12	11	11	11	11	11	11	11	11	11
						axle rpm	**axle rpm**		
.....	12.00–26	12.00–26	12.00–26	13.00–24	13.00–24	.....	.....	.....	.....
1½	1½	1½	1½	2⅛	2⅛	15.72	15.72	.....	.....
2¼	3	3	3	3⅝	3⅝	26.55	26.55	.....	.....
3⅛	3⅞	3⅞	3⅞	5⅛	5⅛	38.26	38.26	.....	.....
3⅞	4¾	4¾	4¾	7¼	7¼	54.13	54.13	.....	.....
5⅜	14	14	14	14⅛	14⅛	104.39	104.39	.....	.....
1¾	1¾	1¾	1¾	2½	2½	18.83	18.83	.....	.....
811	899	899	899	899	899	.....	.....	1500	1500
2335	2587	2587	2587	2587	2587	.....	.....	4319	4319
540 or 862	537	537	537	641	641	.....	.....	.....	.....
1⅜	1⅜	1⅜	1⅜	1⅜	1⅜	.....	.....	.....	.....
.....	⅜	⅜	⅜	⅜	⅜	.....	.....	.....	.....
.....	46¾	46¾	46¾	46¾	46¾	.....	.....	.....	.....
.....	45	45	45	50	50	.....	.....	.....	.....
.....	76	76	76	76	76	.....	.....	.....	.....
58⅝	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	.....	.....	.....	.....	.....	.....	.....	.....	.....
8 to 12	.....	.....	.....	.....	.....	.....	.....	.....	.....
8 to 20	.....	.....	.....	.....	.....	.....	.....	.....	.....
12⅛	11½	11½	11½	11½	11½	11½	11½	.....	.....
bar	bar	bar	bar	pintle	pintle	.....	.....	.....	.....
12¼ fixed	7⅝ to 18⁹⁄₁₆	7⅝ to 18⁹⁄₁₆	7⅝ to 18⁹⁄₁₆	9⅝ to 15⅝	9⅝ to 15⅝	.....	.....	.....	.....
.....	7¼	7¼	7¼	.....	.....	.....	.....	.....	.....
9½	14	14	14	.....	.....	.....	.....	.....	.....

BRIEF DESCRIPTIONS

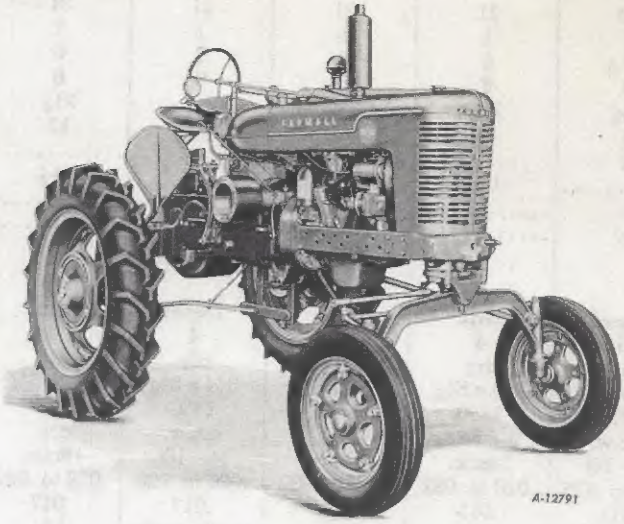


Illust. 4A--The Farmall-M with belt pulley attachment. The tires are 11-38 inch rear, 6.00-16 inch front. Regular steel wheel equipment: 51 inch diameter rear wheels with 8 inch rims and 4 inch spade lugs, and 22-1/2 inch diameter front wheels with 4 inch rims and 2 inch high skid rings.

Farmalls M and MD

Farmalls M and MD are the largest of the Farmall tractors. This size Farmall will pull three 14-inch plow bottoms under most soil conditions. It will pull a 9 or 10-foot tandem disk harrow, or other implements of similar draft requirements. It will handle four-row planters and cultivators, three and four-row middlebusters and listers, and two-row corn pickers. With belt pulley, it operates the larger threshers, shellers, hammer mills and other belt driven machines. With power take-off attachment it will pull and operate a tractor binder, two-row potato digger, and the Farmall mower. The Farmall-MD is powered with the IH Diesel engine. The Farmall-M is powered with the IH carbureted engine, high compression for gasoline or medium compression for distillate-gasoline.

Field speeds for the Farmalls M and MD are approximately 2-5/8, 3-1/2, 4-3/8 and 5-1/4 miles per hour. Where tractors are mounted on pneumatic tires the road speed (5th) is approximately 16 miles per hour. Tractors mounted on steel wheels have the road speed (5th) locked out. This assortment of transmission speeds, together with variable speed engine governor makes it possible to select the most economical speed for the job to be done. Rear wheel treads are variable from 52 to 88 inches to meet a wide range of row crop spacings.



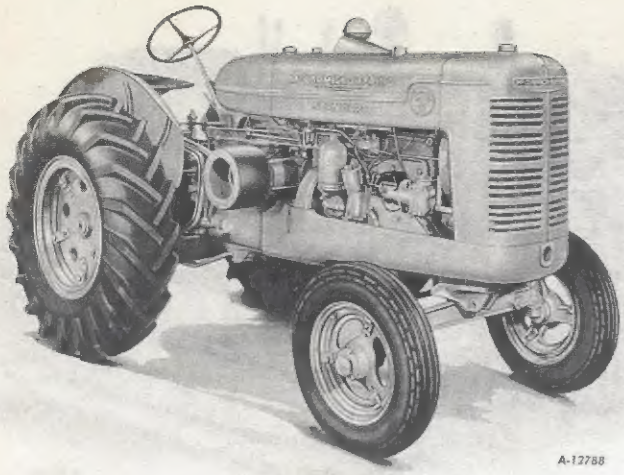
Illust. 4B--The Farmall-MDV tractor, equipped with muffler, electric lights and starter and belt pulley attachments.

Farmalls MV and MDV

Farmalls MV and MDV are high clearance tractors for work in crops planted in high beds. They are especially adapted for use in sugar cane where cultivation is continued until the plants have reached considerable height above the beds. These four-wheel tractors have high arched front axles with 30-1/2 inches of clearance. Rear axle and final drive housings give 10-27/32 inches more clearance than the Farmall-M. Roller chains running in oil are used for the final drives. Wheel treads are adjustable for a wide variety of conditions. Power is ample for operating the No. 2 cane plow or two-row cane cultivator and other direct connected tools. The letter "D" in the model symbol MDV indicates the Diesel engine, while the Farmall-MV is equipped with the carbureted engine.

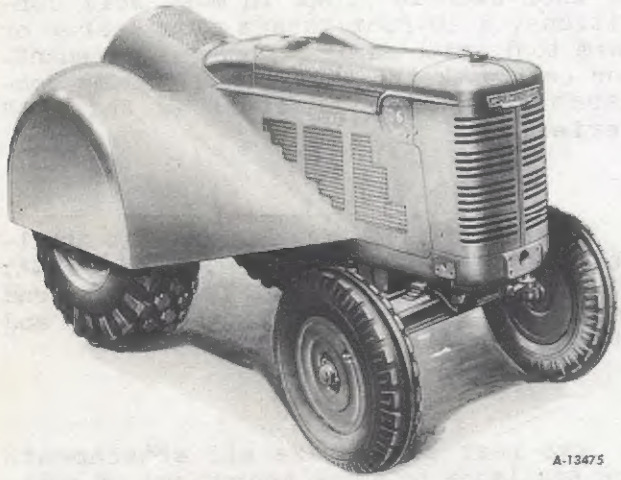
W-6 and WD-6 Standard Tractors

W-6 and WD-6 are medium size standard four-wheel farm tractors. They will furnish ample power to pull three 14-inch stubble plows, drive a 28-inch thresher, pull a 10-foot field cultivator or tools of similar power requirement. Both power take-off and belt pulley output are similar to the Farmall-M. Field and road speeds



Illust. 5A--The McCormick-Deering WD-6 Diesel standard tractor, equipped with 11 inch belt pulley and pneumatic tires, 14-30 rear, 6.00-16 front.

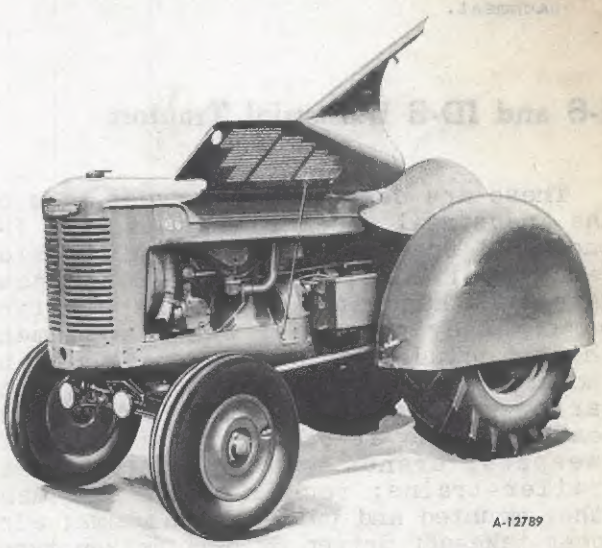
are also comparable to Farmall-M. Tractors equipped with steel wheels have the fifth or road speed locked out of operation. The WD-6 tractor is powered with the IH Diesel engine. The W-6 tractor is powered with the IH carbureted engine, high compression for gasoline or medium compression for distillate-gasoline.



Illust. 5B--The McCormick-Deering O-6 orchard and grove tractor with 6.00-16 front and 13-26 rear tires. All regular equipment shown except the steering wheel cowl.

O-6 Orchard and Grove Tractor

The O-6 tractor is a modification of the W-6 and is adapted to the needs of the larger fruit grower. It will pull a three-bottom plow covering 9 to 13 acres a day, tandem disk 30 to 40 acres per day, or harrow (spring tooth) up to 30 acres. An A.S.A.E. standard power take-off is available for operating the mechanisms of sprayers and dusters. Belt pulley attachment is also available. A hand-operated over-center engine clutch is used in place of the foot operated spring-loaded type of the W-6. The overall height of this tractor is low and the regular turning radius is short (11-1/2 feet); extra short turning radius is provided by means of foot operated steering brakes. A low, low speed and reverse add to the desirable features of the O-6 for orchard work. Streamlining of the fenders and hood avoid damage to the trees or fruit. The O-6 is powered with the IH carbureted engine, high compression for gasoline or medium compression for distillate-gasoline.

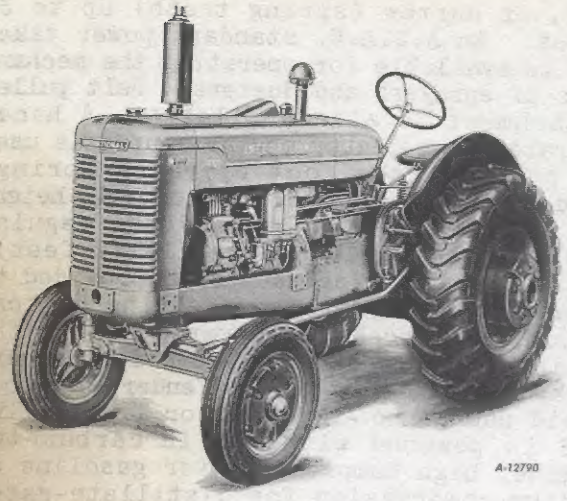


Illust. 5C--If operating conditions do not require the hood side you simply pull out the hinge pin and remove it from the tractor. The engine cover can likewise be removed in a jiffy.

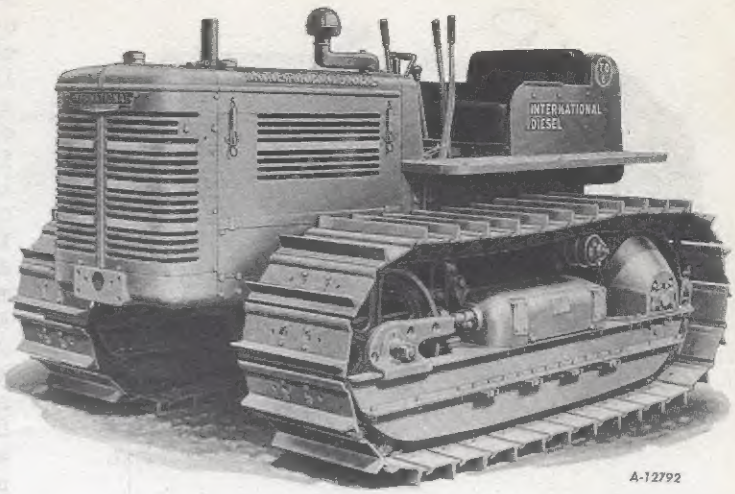
OS-6 and ODS-6 Orchard Tractors

These tractors have the same basic chassis as the O-6 except for the fender equipment. In place of the streamlined hood side sheets, cowl and rear fenders they have the simpler type of fenders as used on the W-6 standard tractor.

The OS-6 tractor is powered with the same IH carbureted engine as the O-6. The ODS-6 tractor is powered with the IH Diesel engine.



Illust. 6A--International ID-6 Diesel tractor with front and rear wheel weights, muffler attachment, and belt pulley attachment.



Illust. 6B--International TD-6 crawler tractor equipped with hood side doors.

I-6 and ID-6 Industrial Tractors

These are next to the largest size of the industrial wheel type tractors. I-6 and ID-6 tractors are used in a wide variety of construction, maintenance, materials handling, and transportation work. They power a list of equipment which includes maintainers; front-end shovels and loaders; road rollers; disk harrows and mixers for mixed-in-place roads; roll-over scrapers; snow plows; sweepers; cranes and hoists; winches; trailer-trains; rock crushers and many other mounted and pull-behind items; also power take-off driven or belt driven types requiring 30 to 40 horsepower as prime mover.

The basic design of these industrial tractors is similar to the standard W-6 and WD-6, except that they have slightly higher working speeds than the "W" type; a foot accelerator is also used making the operation more flexible over the wide range of speeds which the industrial type of operation demands. The drawbar is equipped with a spring mounted pintle hook.

The ID-6 tractor is powered with the IH Diesel engine. The I-6 is powered with the IH carbureted engine equipped with either high compression or medium compression components for smooth economical operation on high octane or low octane fuels respectively.

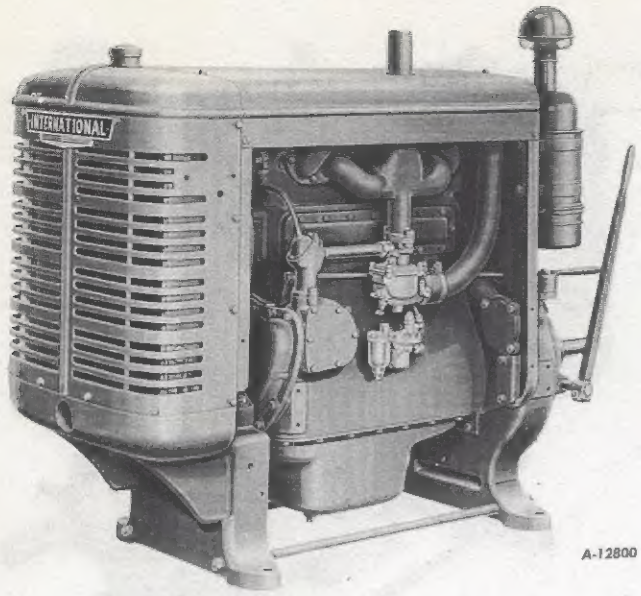
T-6 and TD-6 Tractors

These are the smallest of the IH crawler tractor line. They are used on the farm, in the mills, in the timber and by road builders where the going is tough and where maximum traction and high drawbar efficiency is essential. Ample power is provided to pull four 14-inch or three 16-inch stubble plows in most soil conditions, a 10-foot tandem disk harrow or farm tools with similar power requirement. For belt work the available power is comparable to other tractors in this "6" series.

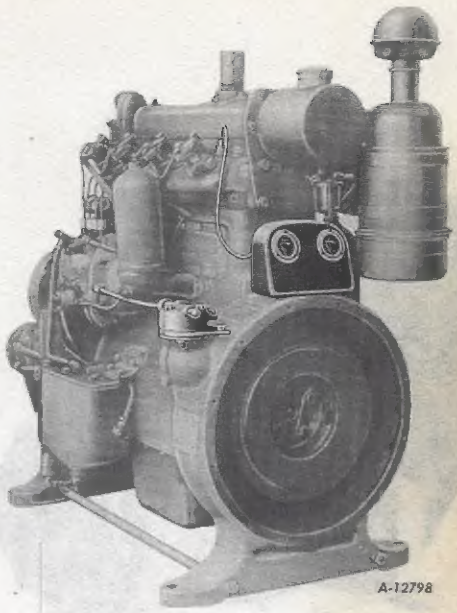
For the industrial user, power is available for operating bulldozers 6 to 7 feet; bullgraders 7-1/2 to 8-1/2 feet; front end shovel 1/2 yard; small logging arches and fire line plows.

Two rear power take-off attachments are available to drive mechanisms of pull-behind machines of both farm and industrial type. One attachment turns at 862 r.p.m., driven directly from the transmission countershaft. A reduced speed power take-off attachment turns at 540 r.p.m., also driven from the countershaft, incorporating a set of reduction gears. A front power take-off coupling is also available for driving front mounted winches.

The T-6 is powered with the IH carbureted engine, the TD-6 has the IH Diesel engine.



Illust. 7A--U-6 power unit complete with fan, radiator, hood and rear sheet, clutch, power take-off and controls.



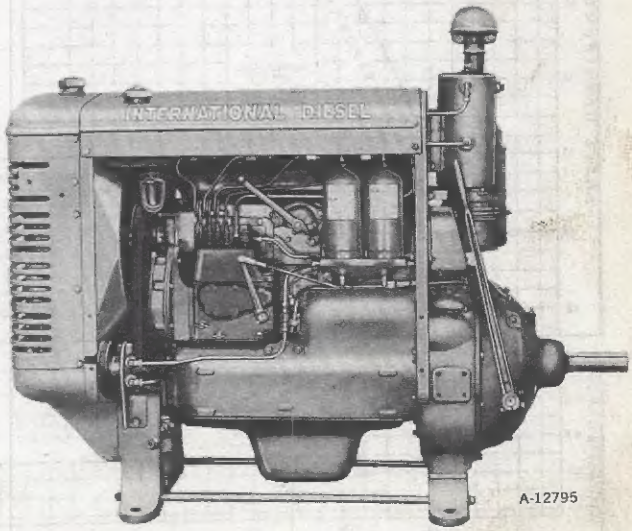
Illust. 7B--Open type unit showing engine speed control and instrument panel which includes oil pressure gauge and water temperature gauge. When ordered, ammeter and starter button (for electric starting) are included in instrument panel.

U-6 and UD-6 Power Units

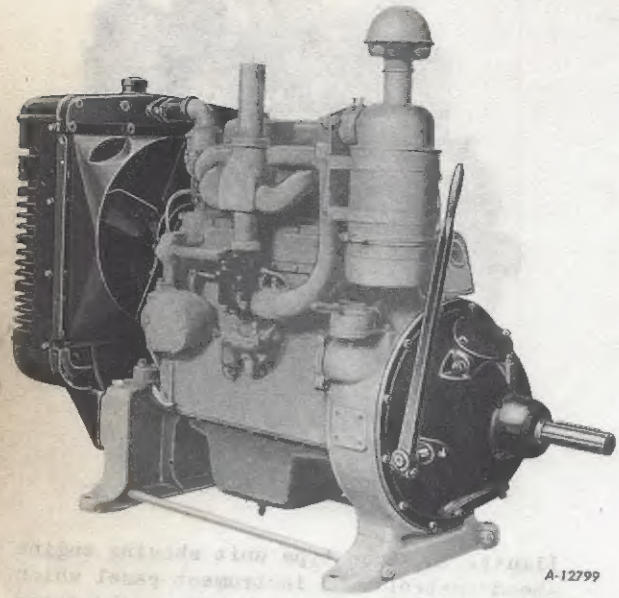
The U-6 and UD-6 power units are third in size of the IH power unit line, coming in the 30 to 40 horsepower range. These units are easily adapted to individual needs because of the equipment combinations available. Besides the basic engine, six basic equipment parts are involved: (1) foot-type base, (2) radiator, fan and connections, (3) air cleaner and connections, (4) engine controls, (5) clutch, controls and power take-off, (6) engine hood and rear hood sheet. Any one or combination of the various equipment units may be attached or removed from the basic engine without interfering with the other units. A combination of the basic engine and all units makes a self-contained power unit ready for connection to the fuel supply.

The flywheel housing is an S.A.E. Standard No. 2. The regular power take-off shaft diameter is 1-3/4 inches and extends out 6 inches from the clutch housing. The square key used to secure a pulley or drive coupling to the shaft is 1/2 x 1/2 x 5 inches. A stub power take-off shaft is also available, which is secured directly to the flywheel where an engine clutch is not used.

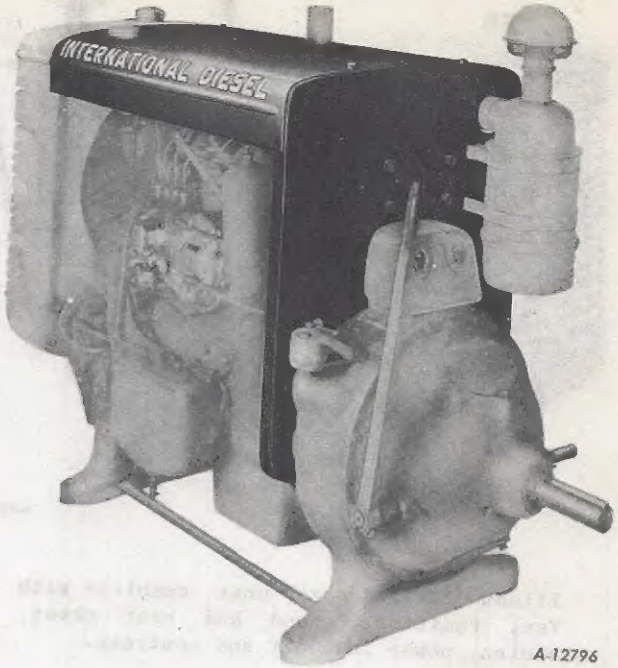
The U-6 power unit is the IH carbureted engine, and equipment is available for use with a wide range of fuels such as 70-72 octane gasoline, distillate, kerosene, and natural or manufactured gas. The UD-6 power unit is the IH Diesel engine. Performance curves for both types of engines are shown in this section.



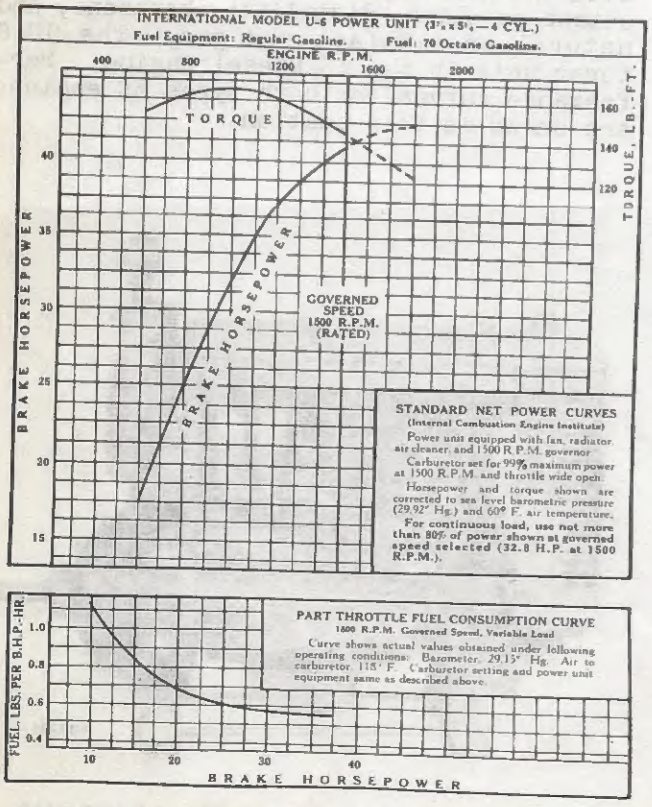
Illust. 7C--UD-6 power unit equipped with IH single plunger injection pump complete with all basic attachments.



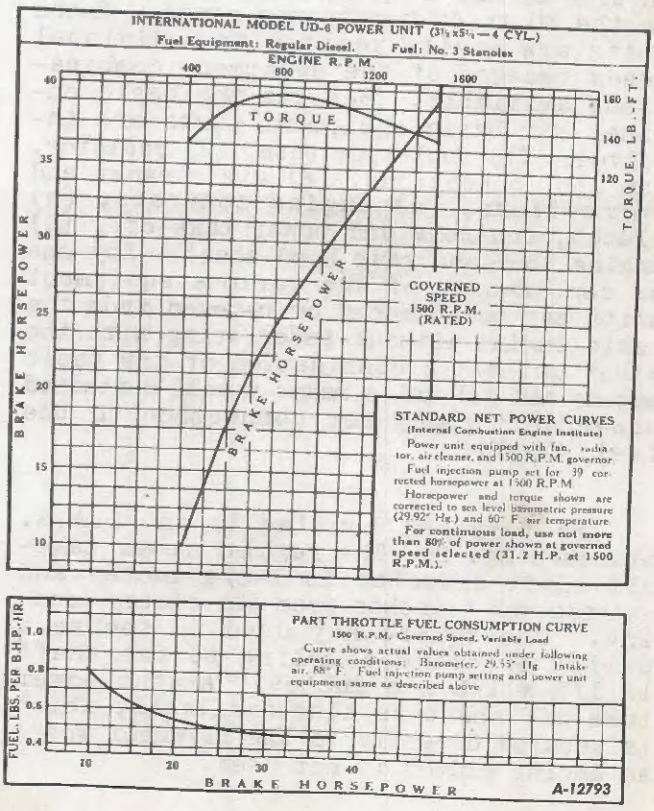
Illust. 8A--Open type power unit with radiator and power take-off.



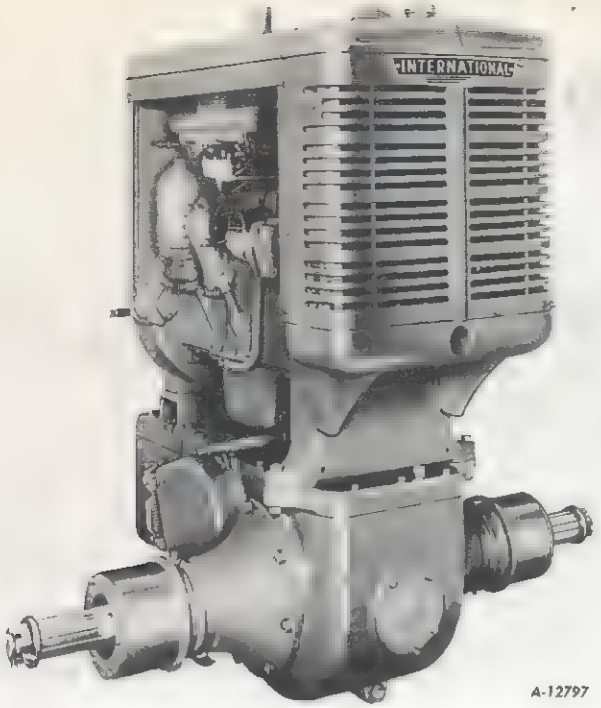
Illust. 8B--Engine hood and rear hood sheet are a separate unit.



Illust. 8C--Performance curve of U-6 carbureted engine.



Illust. 8D--Performance curve of UD-6 Diesel engine.



Illust. 9A--IUD-6 tractor-engine-over-axle unit.

IU-6 and IUD-6 Tractor-Engine-Over-Axle Units

These units of industrial power are furnished as a complete power and transmission assembly to manufacturers of power graders, maintainers and such allied equipment. Each unit is composed of U-6 or UD-6 power unit and the I-6 transmission and rear axle assembly. The foot type base of the power unit rests on a special tractor rear frame cover as shown in the illustration.

The governors of the U-6 or UD-6 power units used in the IU-6 or IUD-6 assemblies are set for maximum full load speed of 1450 r.p.m., and high idle speed of 1595 r.p.m. The transmission likewise is designed to be driven at 1450 r.p.m. The reduction ratios (transmission input shaft to one revolution of axle shafts) and the axle speeds are as follows:

Speeds	Reduction Ratio	Axle Speed R.P.M.
1st speed	92.25	15.72
2nd speed	54.62	26.55
3rd speed	37.90	38.26
4th speed	26.79	54.13
5th speed	13.89	104.39
Reverse	77.01	18.83

SERIAL NUMBER IDENTIFICATION

Each machine carries both chassis serial numbers and engine serial numbers. Prefix letters indicate the unit model, and type of engine used. The addition of the letter "D" to the prefix indicates the use of the Diesel engine in that unit. Suffix letters and numerals in chassis serial numbers indicate any attachments or special features with which the machine has been equipped at the factory, such as low speed gears, high speed gears, high altitude pistons, etc.

When a service report is made it is of the utmost importance to furnish complete chassis and engine serial numbers, also injection pump and magneto serial numbers if these units are involved.

Serial Numbers

Machine	Chassis		Engine		Transmission, Final Drive
Farmall-M. .	FBK 501	and up	FBKM	and up	
Farmall-MV .	FBKV 58712	" "	FBKVM 501	" "	
Farmall-MD .	FDBK 26145	" "	FDBKM 503	" "	
Farmall-MDV.	FDBKV 101494	" "	FDBKVM 2407	" "	
W-6.	WBK 501	" "	WBKM 501	" "	
WD-6	WDBK 516	" "	WDBKM 501	" "	
O-6.	OBK 811	" "	OBKM 501	" "	
OS-6	OBKS 9062	" "	OBKSM 501	" "	
ODS-6. . . .	ODBKS		ODBKSM		
I-6.	IBK 2062	" "	IBKM 501	" "	
ID-6	IDBK 2685	" "	IDBKM 501	" "	
T-6.	TBK 528	" "	TBKM 501	" "	
TD-6	TDBK 501	" "	TDBKM 501	" "	
U-6.	UBK 501	" "	UBKM 501	" "	
UD-6	UDBK 501	" "	UDBKM 501	" "	
IU-6	IUBK 1195	" "	IUBKM 501	" "	EUBK 504 and up
IUD-6. . . .	IUDBK 906	" "	IUDBKM 906	" "	EUDBK 501 " "

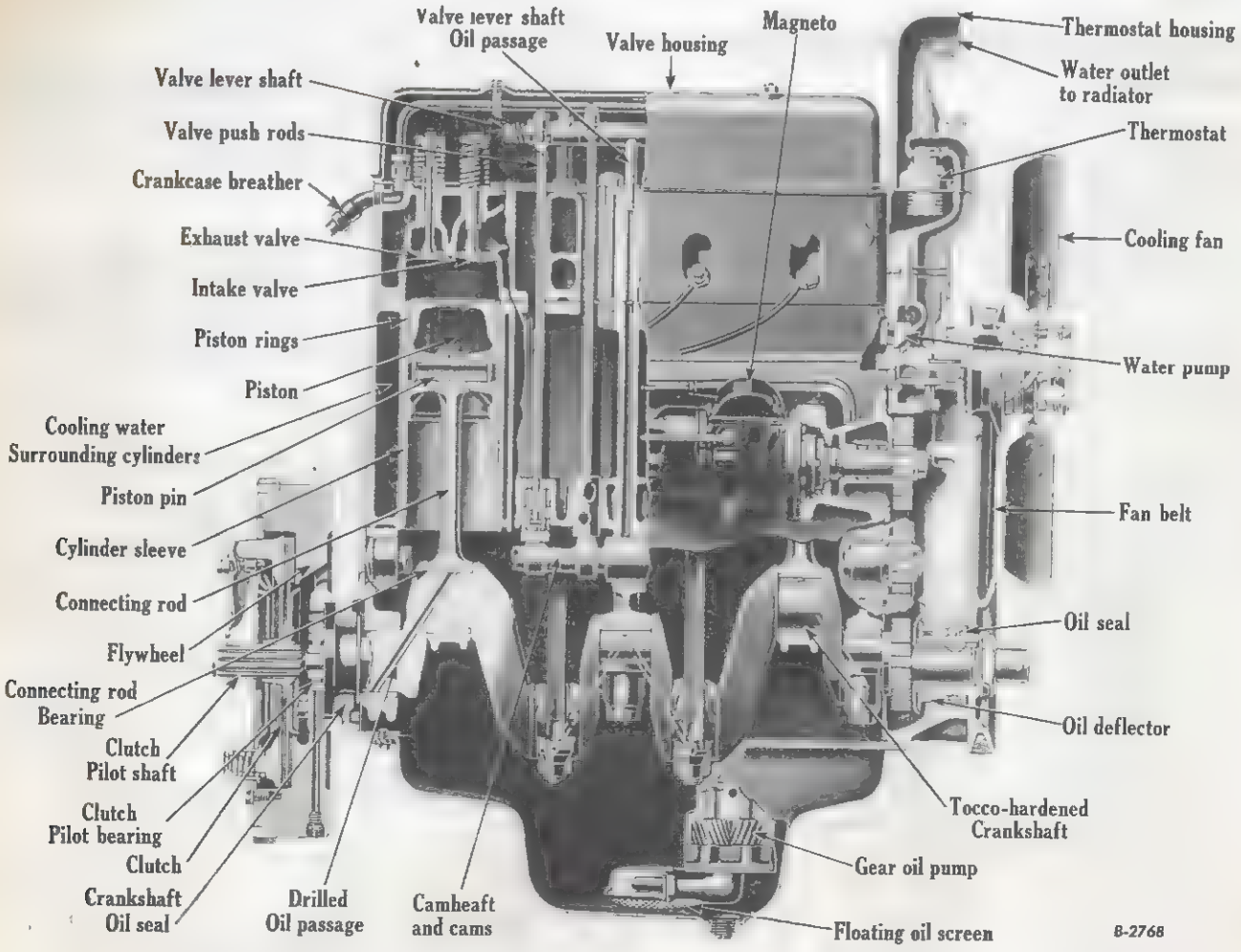
CARBURETED ENGINE

SPECIFICATIONS

Number of cylinders	4
Type cylinder	Replaceable, grey iron, dry liner
Bore and stroke	3-7/8 x 5-1/4 in.
Displacement, per revolution	247.7 cu. in.
Compression ratio, standard altitude	
High compression (gasoline)	5.65 to 1
Medium compression (distillate)	4.75 to 1
Low compression (kerosene)	4.50 to 1
Full load governed speed	
All tractors and IU-6	1450 r.p.m.
U-6 power unit	1500 r.p.m.
High idle governed speed	
All tractors and IU-6	1595 r.p.m.
U-6 power unit	1650 r.p.m.
Minimum governed speed	900 r.p.m.
Low idle speed	425 r.p.m.

DESCRIPTION

The "6" series carbureted engines may be equipped to produce any one of three compression ratios to give the user the type of engine and fuel system needed to meet his fuel requirements and obtain maximum power and economy: (1) A high compression engine with a relatively cool manifold for most efficient operation on gasoline, 70 octane or higher; (2) a medium compression engine with adjustable heat control manifold for most efficient operation on distillate or low octane gasoline; (3) a low compression engine with adjustable heat control manifold for most efficient operation on kerosene or low octane distillate. The compression ratio is



Illust. 10A--Cross section of carbureted engine with spring-loaded clutch.

changed by using different cylinder head and valve assemblies. Piston sets are available to adapt the engine for most efficient operation at various altitudes. These are furnished in three ranges: standard, 5000 foot, and 8000 foot altitudes.

Outstanding features of engine design are the removable, grey iron, dry liner cylinder sleeves, replaceable precision connecting rod and crankshaft bearings and force feed lubrication. Piston pins and cylinder walls are lubricated by oil forced out at the sides of connecting rod bearings and thrown up into the piston and cylinder walls.

The crankcase, valve housing and governor housing are ventilated through a pipe connected to the intake air cleaner to hold condensation of moisture to a minimum. The engine is protected against dust and abrasive material by an oil filter having a large replaceable filtering element and by an oil type air cleaner. Efficient seals are used at all shaft openings to prevent unnecessary wear of engine parts caused by the entry of abrasive dust.

A sensitive variable speed governor makes it possible for the operator to select the most economical speed for the job being done.

These engines are equipped with IH waterproof high tension magnetos having automatic impulse couplings, insuring hot sparks for all engine speeds, and for easy starting.

The various parts of the engine are discussed and service methods are outlined in the sections which follow.

CYLINDER HEAD

Specifications

Stud diameter	1/2 in.
Stud nut tension	110 ft.-lb.
Valve guides, replaceable; service guides reamed to size	
Valve seat angle	45°
Valve seat width	5/64 to 3/32 in.
Valve port diameter	
Intake	1-19/32 in.
Exhaust	1-7/16 in.
Valve seat insert rings; available for exhaust ports only	6337 D

Three distinctly different cylinder heads are used, one for high compression gasoline engine, one for medium compression distillate-gasoline engine, and one for low compression kerosene engine. Changes in compression ratio are necessary to produce engine efficiency when using the fuels indicated. When using these engines at high altitudes the cylinder head is unchanged but ratios are raised by a change of piston type.

Valve Guides

Valve guides are replaceable. Service guides are reamed to give .002 to .004 inch clearance between valve guide and valve stem. Broken, burned, cracked or worn valve guides should be replaced, taking care not to damage the top edge of the bore of the guides when pressing them into the cylinder head. The beveled end of the guide should be up, and the squared end in the valve port, pressed to the following specifications:

8044 DR -- 3-7/32 inches long for high compression head; top of guide should be 1-13/64 inches above counterbore in top of head.

6338 DR -- 2-25/32 inches long for use in both medium and low compression heads; top of guide should be 25/32 inches above counterbore in top of medium compression head and 31/32 inches above counterbore in top of low compression head.

A true valve seat cannot be obtained when valve guides are worn excessively; therefore, examine all guides and valve stems before regrinding valves.

Valve Seats

Valve seats in the head are 45° angle; they should be approximately 3/32 inch wide in the exhaust port and 5/64 inch wide in the intake port; they should contact the approximate center of the valve face. Before refacing the valve seats, worn valve guides should be replaced to insure true seats and prevent the removal of any more seat material than necessary.

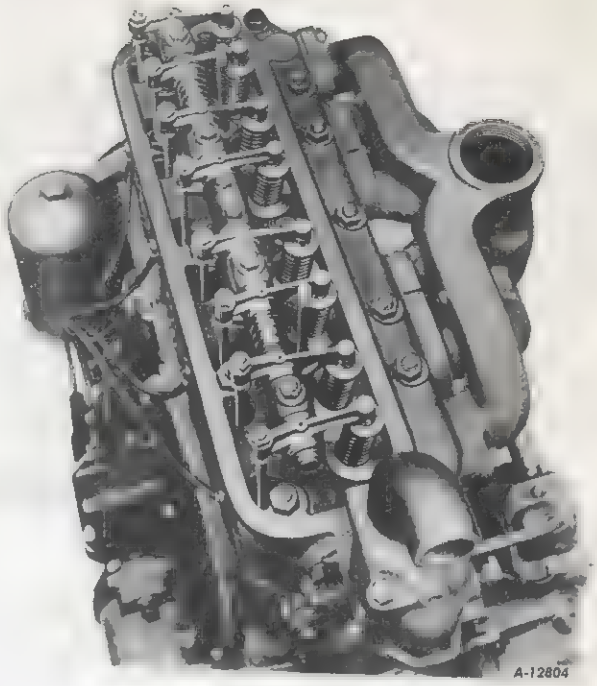
When replacing the cylinder head, the use of a new head gasket is good insurance against leakage and lost time involved replacing a re-used gasket. The proper use of a good torque indicating wrench prevents distorting the cylinder walls and valve seats which might otherwise occur if a cylinder head is tightened unevenly. The sequence of head nut tightening begins at the center of the head and continues back and forth across the head toward the ends.

VALVES

Specifications

Type	Poppet
Location	In cylinder head
Valve length	
High compression head (gasoline)	
50731 DA intake	5-27/32 in.
50732 DA exhaust	5-7/8 in.
Medium compression head (distillate)	
57698 D intake	5-33/64 in.
57699 D exhaust	5-35/64 in.
Low compression head (kerosene)	
48958 D intake	5-25/64 in.
48959 DA exhaust	5-27/64 in.
Valve head diameter	
Intake	1-13/16 in.
Exhaust	1-21/32 in.
Valve stem diameter	.371 to .372 in.
Stem clearance in guide	.002 to .004 in.
Valve face angle	45°
Valve lift	7/16 in.
Material	
Intake	MD-3140
Exhaust	Sil."XCR"
Valve lever clearance (engine hot)	.017 in.
Valve lever shaft diameter	.748 to .749 in.
Valve lever bushing length	1 in.
Valve lever bushing to shaft	
Clearance	.002 to .004 in.
Valve spring free length	2-7/8 in.
Test ... 58 lb., when compressed to 1-25/32 in.	
Valve timing (plus or minus 5°)	
Valves open	
Exhaust	42° before BDC
Intake	5° after TDC
Valves close	
Exhaust	10° after TDC
Intake	41° after BDC

When removing valves from the cylinder head, do not compress the valve springs any further than is necessary to remove the keys or retainers. Clean and inspect valves before refacing. Valves having excessive stem wear, bent stem, or with the head burned, warped, or ground down to a thin edge, should be discarded. Those found fit for re-use may be refaced and the end of the stem squared. Most valve refacing machines have a fixture for re-grinding the stem ends. A valve having a grooved or worn end on the stem tends to crowd one side of the valve stem guide, increasing the wear at this point. The uneven surface also makes it impossible to secure accurate valve lever clearance adjustment.



Illust. 12A--Overhead view of carbureted engine showing valve mechanism.

Valve Springs

Valve springs are the same for intake and exhaust on all "6" series carbureted engines. Springs showing rust pits, distortion or cocked condition, or lack of proper tension should be replaced. The construction of the springs is such that either end may be assembled toward the cylinder head. When installing do not compress more than is necessary to replace the keys or retainers.

Valve Levers

Valve levers are lubricated by pressure from the engine lubrication system. A slot in the center bearing surface of the camshaft allows a metered flow of oil to pass up to the drilled valve lever shaft. Bushings in the valve levers are replaceable and must be reamed to size after being pressed into the lever, to allow a shaft clearance of .002 to .004 inch.

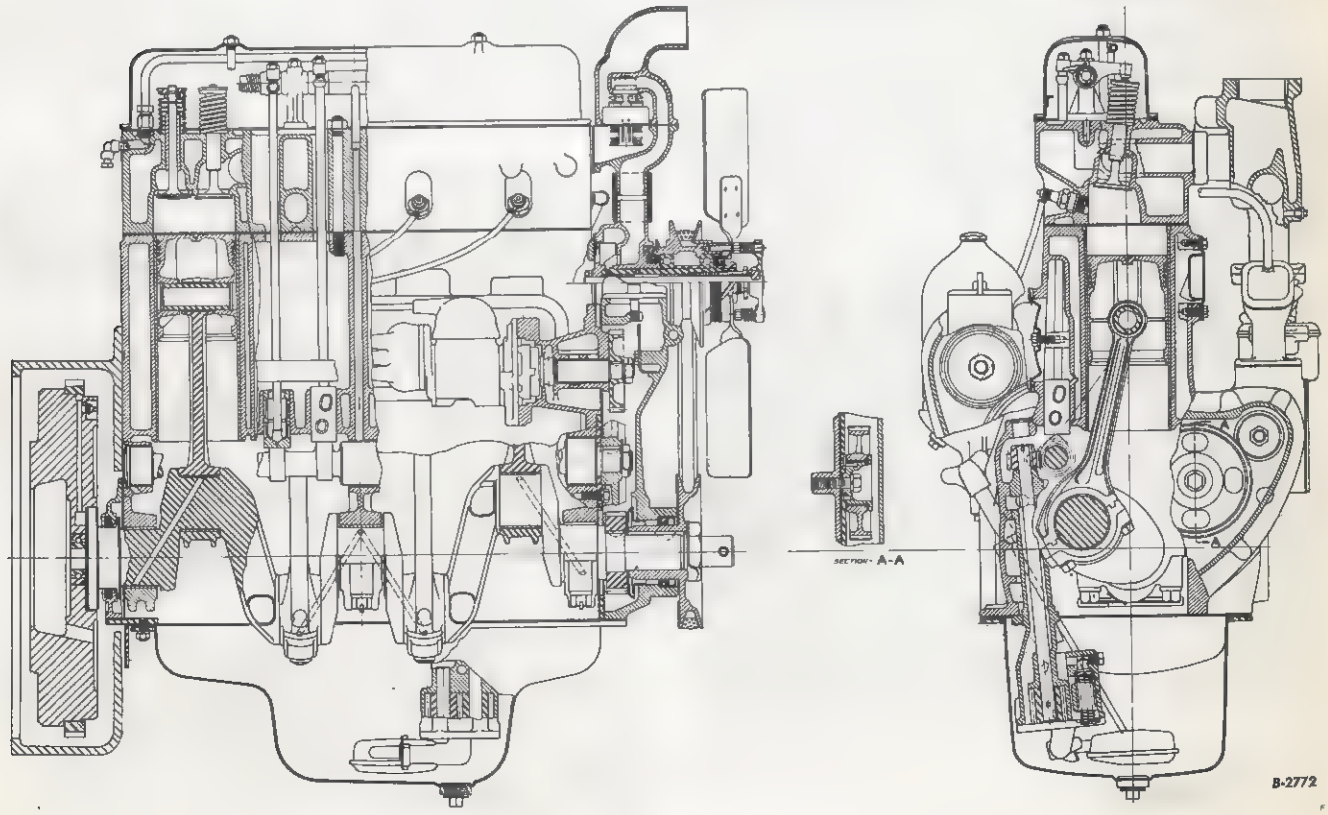
Right and left-hand valve levers must be properly assembled with the brackets on the shaft so that each lever lines up

with its valve. When wear occurs at the valve stem contact face of the valve levers they may be refaced if not worn through the hardened surface. Most valve refacing machines are equipped with an attachment for refacing the valve levers. It is important that this face of the valve lever is in good condition. A worn face may place a side thrust on the valve stem and also makes it impossible to obtain an accurate valve lever adjustment. The clearance between the valve lever and valve stem should be adjusted to .017 inch while the engine is at normal operating temperature. This may be accomplished while the engine is operating at low idle speed or by adjusting the clearance for each cylinder while that piston is at the top dead center of the compression stroke.

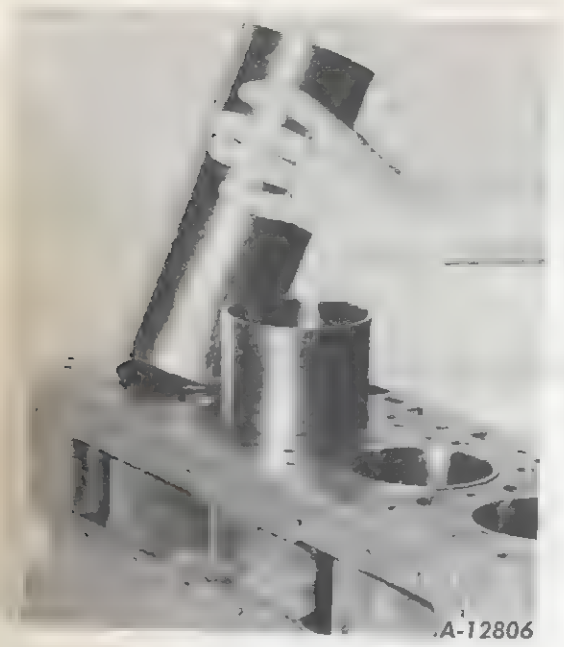
PISTON AND SLEEVE ASSEMBLY

Specifications

Piston material	Grey iron
Clearance in sleeve	.004 to .005 in.
A 1/2-inch wide, .0035-inch ribbon gauge may be used as a "GO" gauge with a light pull of 4 to 6 pounds. A .0045-inch ribbon may be used as a "NO GO" gauge with a tight pull of 11 to 14 pounds.	
Compression rings	
No. 1 (top) plain face, width	1/8 in.
No. 2 plain face, width	5/32 in.
No. 3 taper face, width	5/32 in.
Oil regulating ring, width	1/4 in.
Ring gap	.010 to .020 in.
Clearance in groove	
No. 1 (top) compression	.004 in.
Remaining three	.003 in.
Piston pin (full floating) diameter	1.3125 to 1.3128 in.
Piston pin retainers	Snap rings
Pin clearance in piston	.0001 to .0003 in.
Pin clearance in rod bushing	.0003 to .0005 in.
Cylinder sleeve material	Grey iron
Sleeve type	Dry liner



Illust. 13A--Sectional views of carbureted engine with power unit flywheel and housing.



Illust. 14A--Dry liner replaceable cylinder sleeves.

Cylinder Sleeves

Cylinder sleeves are the dry liner, replaceable type, selective fitted to pistons to give normal measured clearances as listed in specifications. Fitted sleeve and piston assemblies are available for service, singly or in weight matched sets of four, and require no honing or boring after assembly. Mark sleeves and their mated pistons so that upon assembly the same sleeve and piston will operate together.

Puller SE 1213 is available for removal of cylinder sleeves from the crankcase block. The bore of the block must be thoroughly cleaned before new cylinder sleeves are inserted. Abrasive material is NOT to be used in this cleaning process. Coat the outside of the new sleeve with a light film of clean oil for ease of assembly. Where necessary, a wooden block held squarely across the top of the sleeve may be used to pull the sleeve into the bore. The top of the sleeve should be flush to .006 inch above the top of the crankcase block when in place. The engine need not be removed from the tractor or unit to perform this operation.

Piston Rings

Piston rings are available for service in two types, standard production type and compensating type. Where pistons and cylinder walls are new or where only slight wear has occurred it is advisable to use standard production rings. Where piston and cylinder wall wear is within certain limits, engine performance with satisfactory oil control can be secured by the use of compensating ring sets.

Satisfactory results can be expected from compensating ring set installations in "6" series engines where eccentric (egg shaped) wear of the cylinder walls does not exceed .0037 inch and tapered wear does not exceed .0155 inch as measured at the extremes of ring travel; and when piston and top ring grooves do not show more than .006 inch clearance as measured between the side of the groove and a new ring, using a feeler gauge. If wear exceeds these limits, new pistons and cylinder sleeves should be installed.

Piston and connecting rod assemblies are removable through the top of the cylinder bore on "6" series engines.

If a ridge has been worn in the cylinder wall at the upper end of the ring travel, this ridge must be removed with a ridge reamer before the pistons are removed. This prevents damage to piston ring lands during removal of pistons and also damage to new top position rings after installation of new rings.

Piston ring grooves and oil drain holes must be cleaned thoroughly before rings are mounted on the pistons. Care should be used in the cleaning process to prevent damage to the sides of the ring lands.

Check all rings for gap openings by placing rings in lower portion of cylinder bore and measuring the gap with the feeler gauge. Mount the rings in their respective grooves as outlined in the instruction sheets packed with the rings. Do not spread the rings beyond the amount necessary to slip over the piston; a distorted ring is of little value.

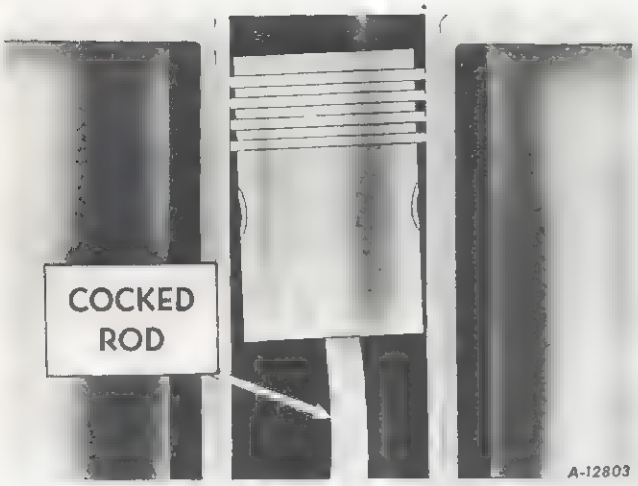
All other factors contributing to oil control of the engine must also be checked and corrected when pistons and sleeves are salvaged by the use of compensating rings. Connecting rods must be aligned; valve guides must be in good condition; the camshaft, crankshaft and their bearings must be in good condition; and external leaks corrected by use of new gaskets and seals.

Piston Pins

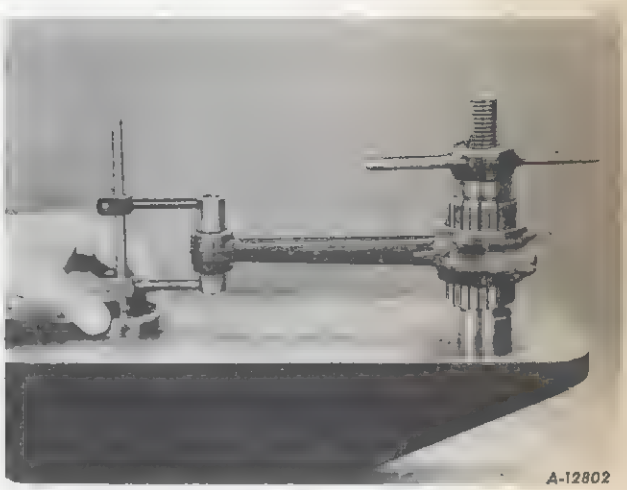
Piston pins are full floating type retained in the piston by snap rings. The piston pins are a hand press fit. An oversize pin (.005 inch) is available.

The piston bore and connecting rod bushing should be reamed or honed to give the clearance listed in specifications. After installing new piston pins the connecting rods must be checked for proper alignment.

CONNECTING RODS AND BEARINGS



Illust. 15A--Bent connecting rods prevent rings from making proper contact with cylinder walls.



Illust. 15B--Fixture and method of checking connecting rod alignment.

Specifications

Rod type	Heat treated, forged I-beam
Distance between bearing and bushing centers	10 in.
Crank bearing	Replaceable precision type
Material	Steel backed babbitt
Length	1-23/32 in.
Shaft diameter	2.4975 to 2.4985 in.
Side clearance on shaft	.008 to .012 in.
Diameter running clearance	.002 to .003 in.
Piston pin bushing	Replaceable
Material	Bronze
Length	1-1/2 in.
Pin diameter	1.3125 to 1.3128 in.
Diameter running clearance	.0003 to .0005 in.
Number of bolts per rod	2
Bolt size	7/16 in.
Nut tension	55 ft.-lb.
Bearing cap, angle of split	45°

Connecting rods are stamped with the cylinder number on both the cap and rod, number one starting at the front (timing gear end) of the engine. The numbered sides of the rod and cap are installed toward the camshaft. The connecting rod bearing running clearance may be checked by placing a .003 inch brass shim (1/4 x 1-5/16 inches) lengthwise between the lower bearing surface and the crankshaft. If the clearance is not excessive, there should be a slight drag when turning the crankshaft with the spark plugs removed.

Bearings are not adjustable; when clearance is excessive the bearings must be replaced. Under no conditions should any attempt be made to file rods or caps to tighten bearings. Connecting rod bearings are available in .003 inch undersize for use on crankshafts with a slight amount of wear, and for the reground "exchange" crankshafts a .030 inch undersize bearing is used.

When installing connecting rod bearings be sure the bearing backs and rod surfaces are absolutely clean, smooth, and free from oil. Bearings have a nib or projection which prevents turning, and must be assembled with the nib engaging the milled notch in the rod and cap. Be sure oil passages in the crankshaft are clean. A rifle barrel brush and air blow gun are useful in thoroughly cleaning such passages. Piston and rod assemblies are removeable through the top of the cylinder bore.

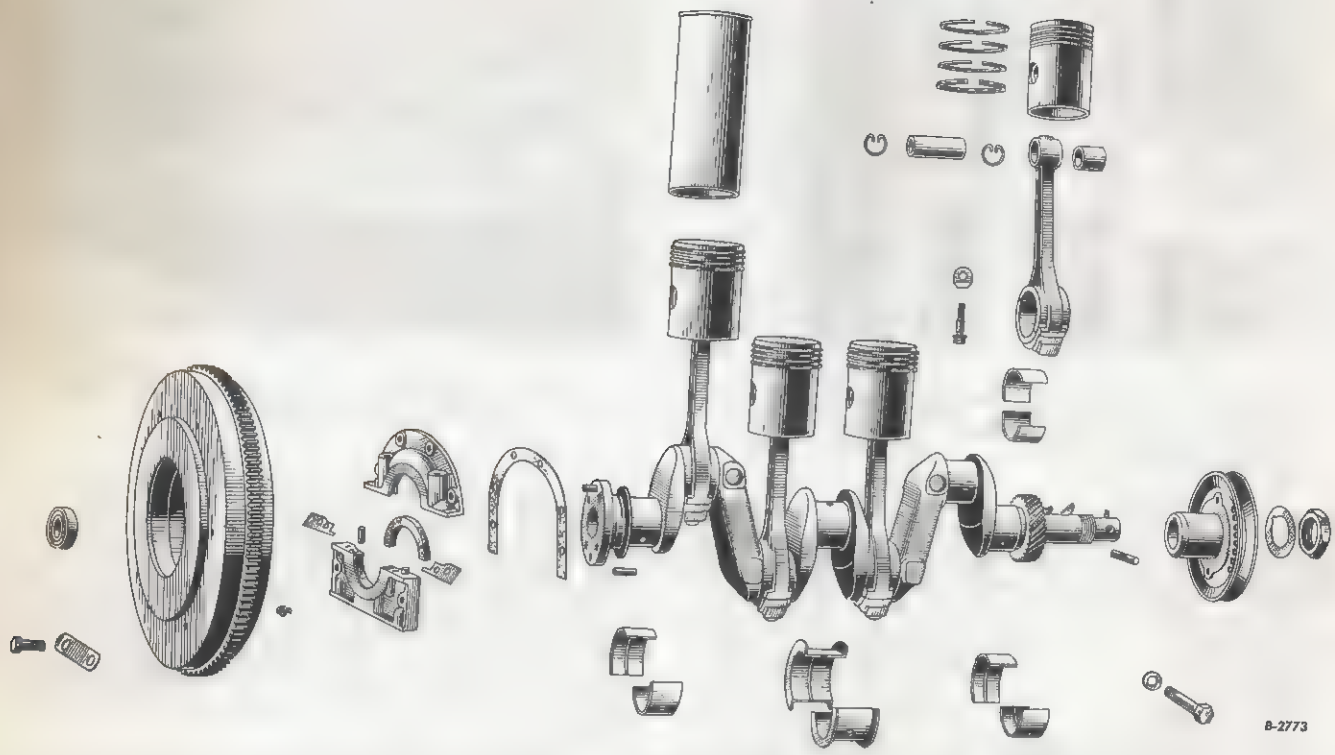
Proper alignment of the connecting rod bearing in relation to the piston pin and piston skirt is most important. Cocked or twisted rods will prevent the piston and rings from contacting the cylinder wall squarely, which will result in oil being pumped up past the rings. When rods are badly misaligned, a knock may develop caused by the rod striking the

piston boss. This indicates the rod is offset toward the front or rear. Many cases of excessive oil consumption have developed after new rings, pins or new piston and sleeve assemblies have been installed, because of neglect to check and correct the alignment of connecting rods.

Misalignment of connecting rods may be caused by engine overloads, detonation, or in the replacement of piston pins, where bushings may be reamed out of parallel with the rod bearing.

The use of a good torque indicating wrench will prevent distortion of connecting rod bearings and also prevent placing undue strain on connecting rod bolts.

CRANKSHAFT AND BEARINGS



Illust. 16A--Exploded views of crankshaft, connecting rods, pistons, sleeve and rear oil seal.

Specifications

Crankshaft	SAE 1045 forging steel with 0.3% chrome
Length, over-all	31-3/8 in.
Weight	74 lb.
Bearing surfaces	Tocco hardened
Main bearings	3
Type	Precision type, steel-backed babbitt
Diameter	2.7475 to 2.7485 in.
Length, front bearing	1.9/16 in.
Length, center bearing	2-1/4 in.
Length, rear bearing	1-9/16 in.
End thrust taken on	Center bearing
End clearance	.004 to .008 in.
Running diameter clearance	.002 to .003 in.
Bearing cap bolt, diameter	9/16 in.
Bearing bolt tension	100 ft.-lb.
Flywheel bolt, diameter	1/2 in.
Flywheel bolt tension	65 ft.-lb.

Crankshafts of the Farmall-M and "6" series engines have Tocco hardened bearing journals and are drilled for pressure lubrication of connecting rod bearings. Each main bearing cap is numbered to correspond with a number stamped on the camshaft side of the crankcase. The precision type bearings are not adjustable; when running clearances become excessive, replacement is necessary.

Main bearing running clearance may be checked by placing a .003 inch brass shim (1/4 x 1-1/2 inches) lengthwise between the lower bearing and crankshaft surfaces. If clearance is not excessive, there should be a slight drag when turning the crankshaft, with spark plugs removed. Check the end clearance with a feeler gauge at the front side of the center bearing on

both the upper and lower thrust faces, being sure the crankshaft is being held against the rear thrust face of the bearing, to show total clearance at the front side.

In an emergency, the crankshaft bearings may be replaced without removing the crankshaft from the case, but extreme care must be taken to insure cleanliness of the bearing backs and crankcase bearing bore. These surfaces must be absolutely clean and dry when installing new bearings. Small particles of dirt between the bearing and the crankcase bore will distort the bearing shell, reducing the running clearance at that localized point and the frictional heat produced results in the bearing material being melted loose from the steel backing at that point. Such melted material lodging between the bearing and shaft at other points of the bearing surface creates other hot spots, until often complete bearing failure results. Anything which interferes with the heat dissipation of a bearing has its effect on the bearing life.

To remove the upper half of a bearing with the crankshaft in place, insert in a crankshaft journal oil hole a cotter pin, or its equivalent, which has the rounded head flattened to form a "T" and then rotate the crankshaft to push out the bearing. The bearing cap and bore are milled to receive the projection on the back of the bearing; the projection end is removed first. When replacing, rotate the shaft so the projection enters last.

To remove the rear main bearing cap it is first necessary to remove the crankcase rear dust seal plate and gasket and the crankshaft rear oil seal retainer plate.

Replacing the crankshaft main bearings without removing the crankshaft should be done only in an emergency. When these bearings are worn sufficiently to require replacement or have failed through lack of lubrication, the entire crankcase and its oil distribution bores should be thoroughly cleaned. This cannot be accomplished without the removal of the crankshaft. The crankshaft front and rear oil seals should also be replaced. This cleaning of the crankcase and replacing of oil seals is the best insurance against early bearing failure through dirt left in the crankcase oil distribution bores or from dirt entering worn crankshaft oil seals.

Crankshaft main bearings are available in standard size, .003 inch undersize for a shaft only slightly worn, and .030 inch undersize for use with the reground "exchange" crankshaft. One defective main bearing will require the replacement of all three bearings; otherwise crankshaft alignment cannot be maintained.

A good torque indicating wrench should be used when tightening the main bearing cap bolts to insure even tension on all bolts and prevent distortion of caps or crankcase. The bearing bolts are locked by lacing soft steel wire through the drilled bolt heads.

Oil Seals

Oil seals are provided at the front and rear of the crankshaft. The front seal is combination felt and leather, located in the crankcase front cover; assemble with the felt portion of the seal toward the outside. The rear oil seal is split type felt; the flywheel must be removed to replace this seal. When an oil leak occurs between the flywheel and crankcase, check the fit of the expansion plug (2-1/8 inch) at the rear of the camshaft; also check the rear main bearing for excessive wear, and replace all gaskets, and felt of the rear oil seal.

Flywheel

The flywheel is secured to the crankshaft flange by four 1/2 inch diameter bolts. These should be tightened with a good torque indicating wrench to 65 ft.-lb. and locked with metal lock strips.

CAMSHAFT AND BEARINGS

Specifications

Camshaft	SAE 1015 forging steel, wearing surfaces carburized and hardened
Length, over-all	24-13/32 in.
Type of drive	Helical spur gear
Number of teeth in gear	58
Bearing journals	3
Front journal	2.243 to 2.244 x 1-7/16 in.
Center journal	2.118 to 2.119 x 1-5/32 in.
Rear journal	1.868 to 1.869 x 1-1/16 in.
Bearing material	Steel-backed babbitt
Running clearance	.0015 to .0035 in.
Service bearings	Finished to size
Thrust plate material	Steel
End clearance	.003 to .011 in.
Lubrication	Pressure

The camshaft of Farmall-M and "6" series carbureted engines is mounted in three replaceable steel-backed babbitt bearings, which are pressed into the crankcase. These bearings, when furnished for service, are finished to proper size and do not require reaming after installation.

End clearance is limited by a retaining thrust plate between the crankcase and the drive gear. The rear bore in the crankcase is sealed from oil leakage into the flywheel housing by use of an expansion plug (2-1/8 inch). The oil pump is driven from a gear cut directly in the camshaft. The magneto is driven by the camshaft drive gear.

The camshaft is removed by first removing or raising the valve tappets to clear the largest diameter of the shaft; second, removing the oil pump complete, and by removing the two 3/8 inch cap screws from the camshaft retaining thrust plate. These cap screws may be removed through openings in the drive gear. This allows the camshaft to be removed from the front end of the crankcase.

After worn bearings are removed from the crankcase, care should be taken to clean the bores and remove any burrs or sharp edges which would distort the new bearings upon installation.

The new bearings may be pulled into the crankcase by use of a bolt and heavy washers. One side of the washers must be trimmed a small amount to center the bolt in the bearing to prevent cocking. Or new bearings may be driven in by use of a punch with a heavy plate next to the bearing. When in place, the forward end of the three bearings should be flush with the front faces of their respective bores, and the oil holes properly lined up.

TIMING GEARS

Specifications

Crankshaft pinion	29 teeth
Camshaft gear	58 teeth
Magneto gear	29 teeth
Governor gear	17 teeth
Idler gear	41 teeth
Type of teeth	Helical

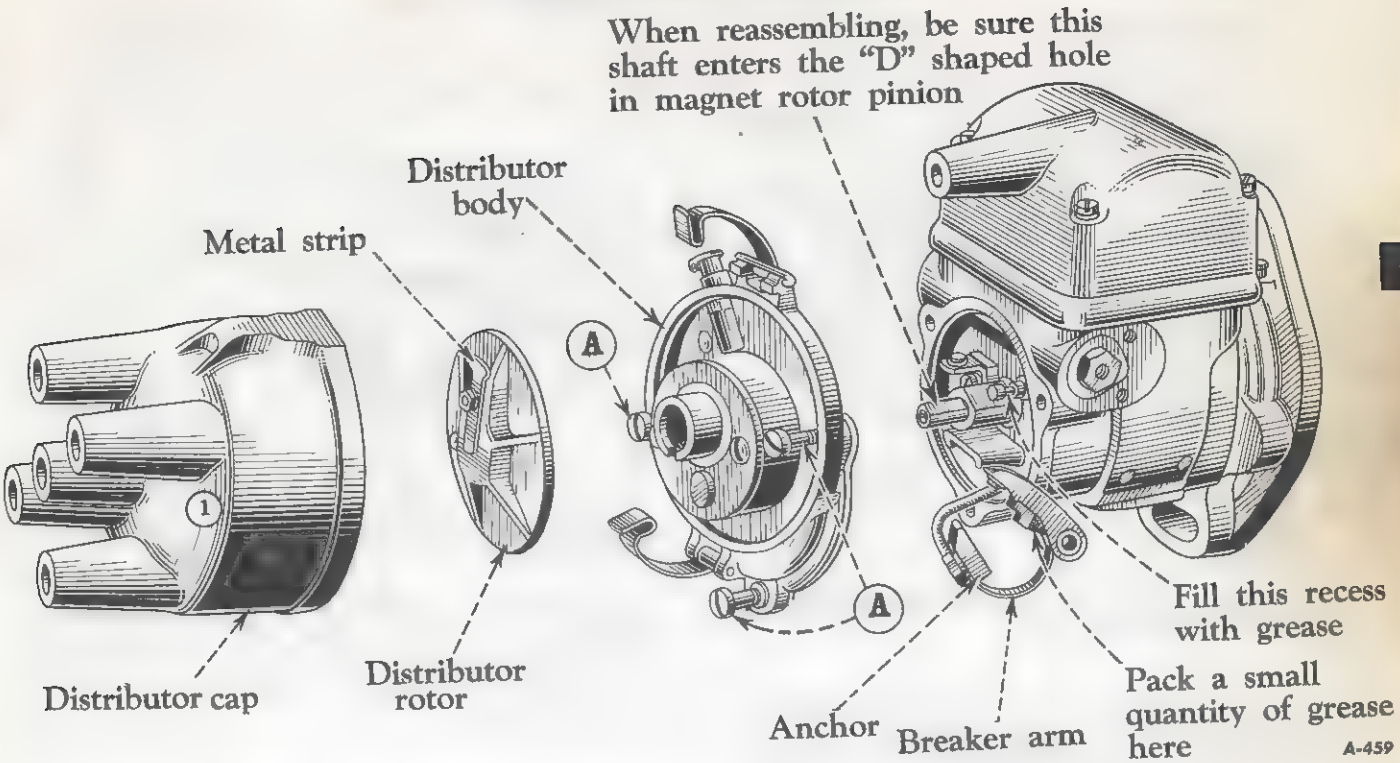
With the crankcase front cover removed, the timing gear train is accessible. The camshaft gear is driven directly by the crankshaft pinion; the magneto gear is in turn driven by the camshaft gear. These three gears must be properly meshed to have the engine timed correctly.

The crankshaft pinion gear has a single punch mark on a tooth which must line with a single punch mark between the teeth of the camshaft gear. The camshaft gear has two punch marks between teeth which must line with two punch marks on a tooth of the magneto gear.

The governor gear is driven from the crankshaft pinion through an idler gear; no timing is involved between these gears. The idler gear has a bushing which turns on an idler shaft. The idler shaft is secured to the crankcase by a 1/2 inch cap screw and a dowel pin. Lubrication to the idler shaft is by pressure.

The timing gears are all a press fit on their shafts, with proper positions secured by Woodruff keys. When removing or installing these gears be sure no pressure is placed on the helical gear teeth which would damage or distort the teeth, resulting in a noisy gear train.

IGNITION SYSTEM



Illust. 19A--Distributor body removed to allow access to breaker points.

Specifications

Magneto	IH Model H-4
Rotation	Clockwise
Breaker point gap	.013 in.
Impulse coupling trips	T.D.C.
Spark advance	35°
Magneto drive gear, helical teeth	29
Spark plug, size	18 mm., 7/8 in. hex
Spark plug gap	.028 to .032 in.
Firing order	1-3-4-2

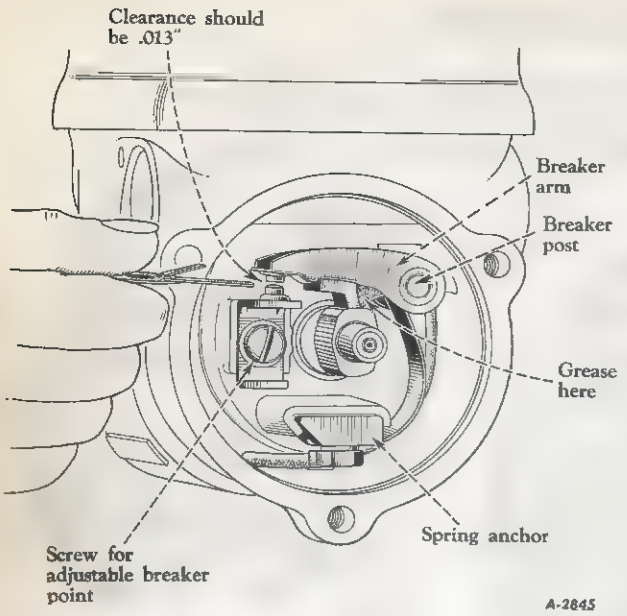
Magneto

The magneto used on the "6" series carbureted engines is IH model H-4. It has a fixed spark, turns clockwise (facing drive end), and is flange mounted to the crankcase. It includes an automatic impulse coupling for starting purposes, which retards the spark timing 35°. The impulse coupling trips at top dead center of the piston travel. The magneto drive operates at the same speed as the engine crankshaft.

Greasing the breaker mechanism and checking the points can be accomplished as follows: Remove the distributor cap. Crank the engine slowly until the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap, and the impulse coupling just trips. Remove the distributor rotor. Take off the distributor body by removing the three screws "A" (illust. 19A). This exposes the breaker chamber.

It is important to keep the breaker chamber clean, as oil on the breaker points will cause arcing and rapid point wear. Overlubrication of the distributor bearing oil cup may result in a dirty breaker chamber. If the chamber is clean no attention is necessary except checking the point opening. If the chamber is dirty all parts must be thoroughly cleaned, the points redressed, point opening clearance corrected and the breaker arm regreased as outlined below.

Slip the breaker arm and spring anchor from the chamber and clean all parts. Inspect the breaker points, and if necessary, dress them with a sharp fine file. If either point is worn excessively replace both points. Fill the recess in the breaker arm post with IH magneto grease and pack a small quantity at the back of the breaker arm rubbing block (see illust. 19A). Assemble the breaker arm, leaving the spring anchor projecting 1/8 to 3/16 inch out of its slot so it is pushed into place by the installation of the distributor body. Be sure the points line up after the breaker arm is in place.



Illust. 20A--Checking breaker point clearance with feeler gauge.

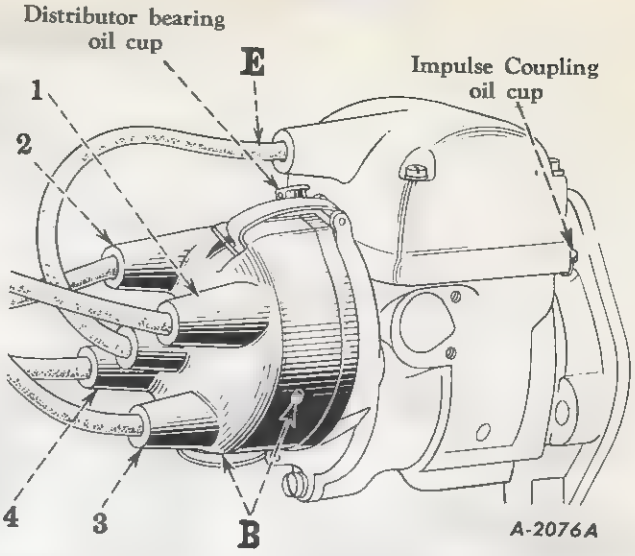
Check the gap between the breaker points, using a .013 inch feeler gauge, being sure the rubbing block is on the high point of the cam (see illust. 20A). If the gap is not correct, adjust by loosening the screw holding the adjustable point, moving the point up or down until the gauge slips smugly between the points. After proper adjustment has been made, tighten the screw and recheck with the gauge.

Line up the distributor rotor key with the keyway in the spindle (see illust. 19A) and press the rotor loosely on the spindle. With the No. 1 piston on top dead center of the compression stroke, turn the distributor rotor until the metal strip on the rotor points to No. 1 terminal on the distributor cap. Place the distributor body on the magneto, being sure the rotor shaft enters the D-shaped hole in the distributor pinion. Remove the distributor rotor to tighten the three screws "A" (illust. 19A). Replace the rotor and distributor cap.

The distributor cap should be kept reasonably free from dust and oil deposits, and the rotor should also be kept clean. Two small ventilating holes "B" (illust. 20B) at the bottom of the distributor cap should be kept open at all times to help reduce condensation of moisture in the distributor.

Removing the Magneto

Removal of the magneto from the engine is accomplished by disconnecting the switch wire from its terminal on the side of the magneto, disconnecting the spark plug cables and removing two cap screws and washers which hold the magneto to the drive bracket.



Illust. 20B--Distributor end of magneto showing oil cups and vent holes "B".

Installing and Timing Magneto

1. Pull out the center cable "E" (illust. 20B) from the coil cover of the magneto to prevent possibility of accidental starting.

2. Crank the engine until the No. 1 piston (timing gear end of the engine) is on the top dead center of the compression stroke. The compression stroke can be determined by removing the No. 1 spark plug, placing your thumb over the opening, and cranking the engine until outward pressure is felt. Continue cranking slowly until the first notch on the fan drive pulley is in line with the timing pointer in the front crankcase cover. Both valves are now closed and the piston is in proper position for timing.

3. Remove the distributor cap and turn the magneto coupling in a counterclockwise direction (as viewed from the coupling end) until the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap. Replace the cap.

4. Assemble the magneto on the engine, making sure that lugs on the impulse coupling engage in slots on the drive coupling. Assemble the magneto so that the top of magneto is as close to the crankcase as possible.

5. Insert cap screws with washers in the magneto flange and tighten only sufficiently to hold the magneto in place. Then crank the engine one complete revolution to the first notch on the fan drive pulley again. Now, slowly move the upper part of the magneto away from the engine until the impulse just trips.

6. Without moving this position of the magneto, tighten the mounting cap screws securely. Attach the spark plug cables, connecting the No. 1 cylinder spark plug cable to the socket marked "1" on the distributor cap; connect No. 3 plug with No. 3 socket; next No. 4; next No. 2 (see wiring chart illust. 21A).

7. Connect the switch cable to the magneto terminal.

8. Recheck the timing by cranking the engine slowly. The impulse should trip each time the first notch of the lower fan pulley lines up with the pointer in the front crankcase cover.

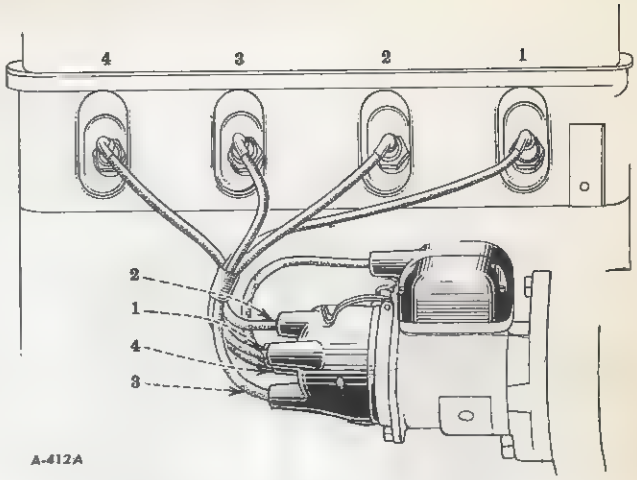
9. If found to be correct, replace the center cable "E" (illust. 20B) in the magneto coil cover.

For complete servicing information on the H-4 magneto, refer to the Blue Ribbon Service Training Course, Manual No. 1, form CHS-27.

Spark Plugs

Spark plugs used in regular production are of a heat range selected to meet the demands of moderate or normal service. Should the engine be subjected to severe or extremely severe service, the burning of spark plug porcelains or electrodes may occur, resulting in pre-ignition from the overheated elements. Such an operating condition calls for installation of colder (severe service) spark plugs. To remedy fouling or sooting as the result of light-load service, use a hotter (light service) spark plug. Refer to spark plug charts issued from time to time.

Sand blasting is the recommended method of cleaning spark plugs. Never scrape or clean the insulator with anything which will scratch or leave a metallic deposit on the porcelain. Adjust electrode gaps by bending only the outer electrode.



Illust. 21A--Ignition wiring chart; firing order of engine is 1, 3, 4, 2.

Spark Plug Cables

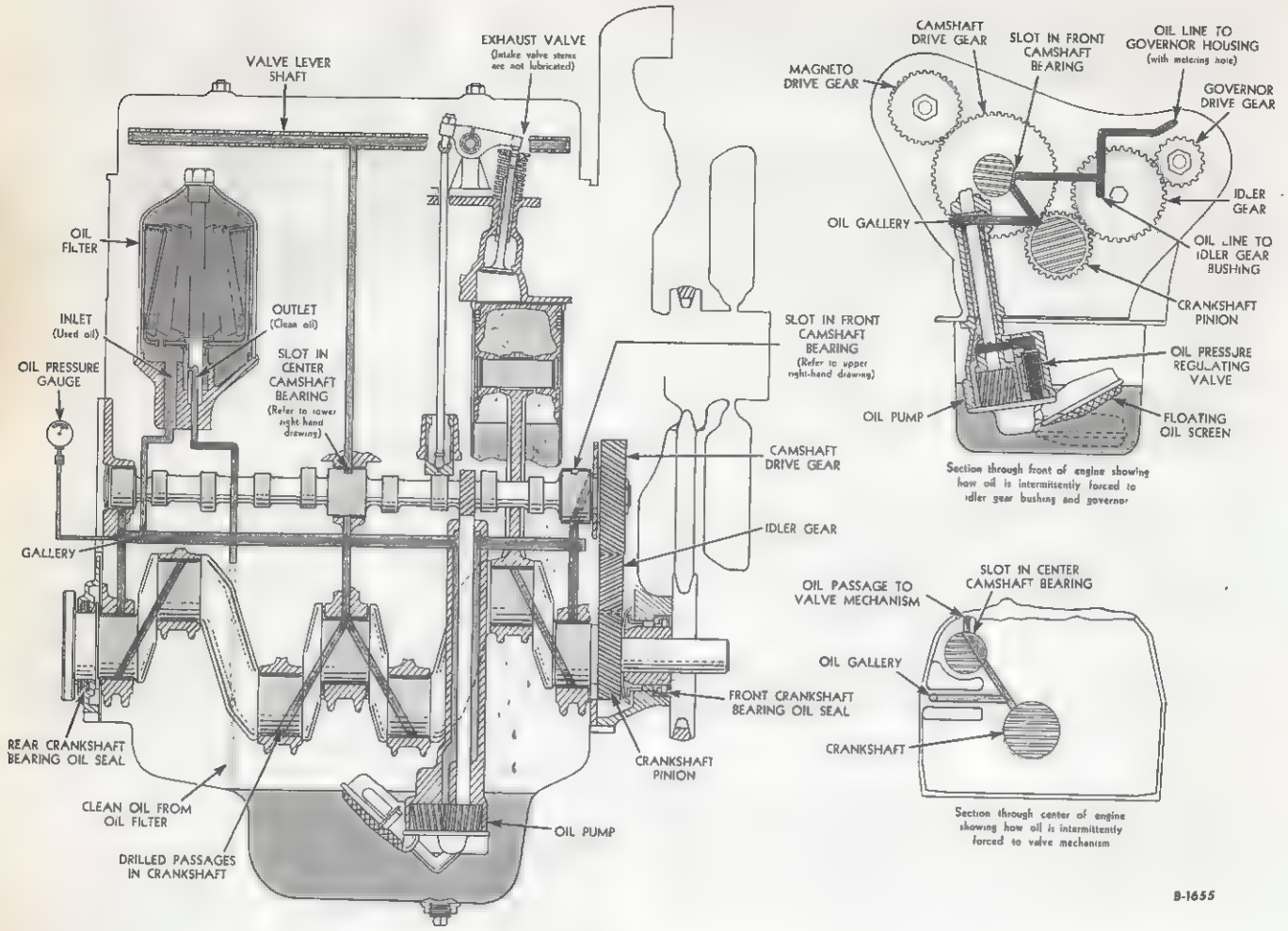
Spark plug cables should clear the cylinder head or block by 1/4 inch to prevent damage to cables from heat, and resulting shorting-out of the spark plug. The magneto ends of the cables should be firmly seated in their sockets to prevent sparking within the sockets, resulting in damage and corrosion to terminals. Cables with cracked or oil soaked insulation should be replaced to insure maximum hot spark at the plugs.

Magneto Bracket

The magneto bracket with gasket is secured to the crankcase front plate by four 3/8" inch cap screws. The bracket, shaft and gear assembly may be removed without removing the crankcase front cover, as the opening in the front plate is of sufficient size to allow the magneto drive gear to pass through. The bushing in the housing is a steel-backed babbitt replaceable type. The bushing is reamed to size after being pressed into housing. The shaft diameter is .9995 to 1.0005 inch. The running clearance of the shaft in the bearing should be .001 to .003 inch. The end clearance of the shaft with gear assembled is .003 to .013 inch.

When replacing the bushing, the 9/16 inch holes should be assembled to the front end of the bracket and arranged vertically to line up with similar holes in the bracket; the small holes are then toward the magneto end. The end of the bushing should be flush with the front face of the bracket. The bushing must be reamed so that the bore is square with the mounting face to maintain the alignment of the gear.

ENGINE LUBRICATION SYSTEM



Illust. 22A--Schematic diagram of carbureted engine lubrication system.

Specifications

Type	Pressure system
Pump (all except T-6)	Single stage, helical gear
Pump (T-6 only)	Single stage plus auxiliary
Drive	Gear driven from camshaft
Body gears, diameter clearance	.004 to .006 in.
Body gears, end clearance	.003 to .005 in.
Body gears, teeth backlash	.003 to .006 in.
Oil intake	Floating screen
Pressure regulator valve	In pump body
Valve diameter	.900 to .901 in.
Valve diameter clearance	.004 to .006 in.
Valve spring free length	3-49/64 in.
Test	42 lb. when compressed to 2-3/32 in.
Oil pressure at governed speed	60 to 70 lb.
Oil filter, replaceable element, "Umbrella" type	
Filter material	Impregnated cellulose
Replacement interval	120 hours
Crankcase oil capacity (all except T-6)	8 qt.
Crankcase oil capacity (T-6 only)	9 qt.

Description

The engine lubricating oil is taken from the oil sump through a floating screened intake to the pump. This floating intake takes oil from near the surface of the oil in the pan; thus sediment or dirt which may have accumulated in the bottom of the pan is not picked up to be circulated by the pump. The floating intake is pivoted from the oil pump cover and must be free to move up and down. The oil pump used on the T-6 crawler tractor is provided with an auxiliary set of pump gears, which return oil from the shallow front end of the pan back to the sump, when the tractor is operated at extreme angles.

Pressure in the oil distribution lines, produced by the oil pump, is controlled

by a spring-loaded regulator valve in the pump body. Oil distribution lines leading from the oil pump consist of a drilled passage or gallery in the crankcase to the crankshaft, camshaft and to the oil filter base. A portion of the oil delivered to the filter passes through the filter element and back to the oil pan through a metering opening in the filter retaining bar.

From the crankshaft bearings oil is delivered through drilled passages in the shaft to the connecting rod bearings. Oil thrown from the connecting rod bearings and crankshaft lubricates the piston pins, cylinder walls and valve tappets.

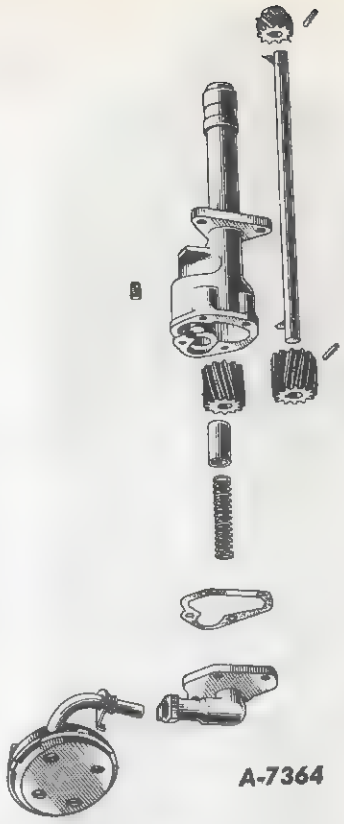
From the camshaft center bearing a drilled passage leads up to the cylinder head, through the head to the valve lever shaft. The flow of oil is metered to the valve lever shaft by a slot in the camshaft journal which allows a small quantity of oil to flow each revolution of the camshaft.

The timing gears, governor and magneto drive shaft are lubricated from the front camshaft bearing, metered by a drilled passage and a slot in the front camshaft journal. Each revolution of the shaft the drilled passage delivers oil to the camshaft thrust plate between the camshaft and camshaft gear. Excess oil supplied to this point provides lubrication to the timing gears. The slot in the camshaft journal allows oil to be intermittently forced to the idler gear shaft and governor housing; excess oil from the idler gear shaft also provides additional lubrication to timing gears. Lubrication of the magneto drive is supplied by oil thrown by the timing gears.

Oil Pump

The oil pump is secured to the crankcase by two 7/16 inch cap screws and lock washers, and is driven from a spiral gear which is a part of the camshaft. The oil pump drive shaft extends down from the spiral driven pinion through the oil pump body to the base which incloses the two oil pump body gears, one of which is keyed to the drive shaft; the second body gear is an idler (see illust. 23A). Gaskets are used between the pump body and pump cover to secure the proper end clearance of the body gears.

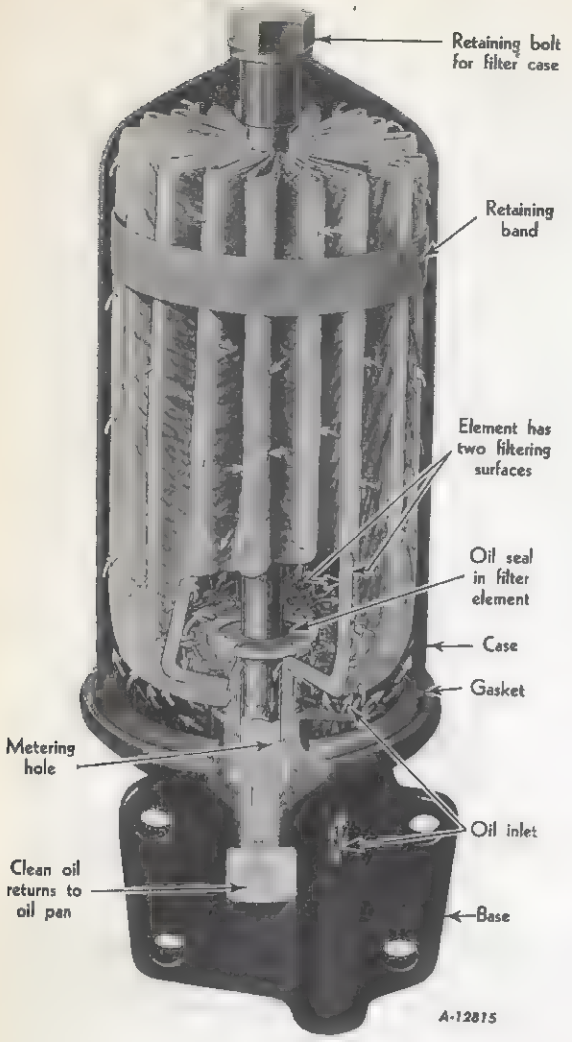
The oil pump used in the engine of the T-6 crawler tractor is similar to



Illust. 23A--Exploded view of oil pump.

the above description, with the addition of an auxiliary set of pump gears and housing which is assembled between the main pump body and the pump cover. The drive shaft and idler shaft are longer, extending through the auxiliary gears. Oil taken through the main floating screen passes up a tube directly to the main pump gears, and into the distribution lines. Oil taken in through the auxiliary intake tube is delivered by the auxiliary gears to the pump cover, up through the hollow idler shaft and discharged through an opening in the body above the idler shaft. In this manner oil picked up at the front of the oil pan, when operating at extreme angles, is returned to the sump to insure a constant supply of oil to the engine.

To disassemble the oil pump, remove the cover from the pump body and thoroughly clean all parts. Inspect the idler shaft and gears and drive shaft and gears, for wear. Check the running clearance between the gear diameters and the body, also the end clearance between the gears and body cover. Gaskets are used between the body and cover to adjust this end clearance. In the T-6 crawler tractor, pump gaskets are provided be-



Illust. 24A--Cutaway view of oil filter showing passage of oil through both inside and outside surfaces of the accordion-pleated, cellulose filter element.

tween the auxiliary housing and the main body for end clearance adjustment of main gears, and between auxiliary housing and cover for adjustment of end clearance of auxiliary gears. Running clearance and end clearance are important factors in maintaining the output of the pump. Replace worn parts to bring clearances back to normal as given in the specifications.

The normal output of the oil pump is many times the normal requirement of the engine lubricating system, and all oil supplied by the pump cannot escape through the engine bearing clearances and metered passages. A spring-loaded regulator valve is employed to release the excess oil and maintain a pressure of 60 to 70 pounds, at 1450 r.p.m. This piston-type valve and its spring may also be inspected after removing the pump body cover (and auxiliary housing on T-6). The valve should slide freely in the body bore, and the spring should be straight so that the valve will not be cocked in the body bore or on its seat.

The free length of the pressure regulating valve spring will give some indication of its condition, however the best test to determine the spring tension is to load it with the weight specified and measure its length at that load. If this tension length test is under specifications, the spring should be replaced.

Oil Filter

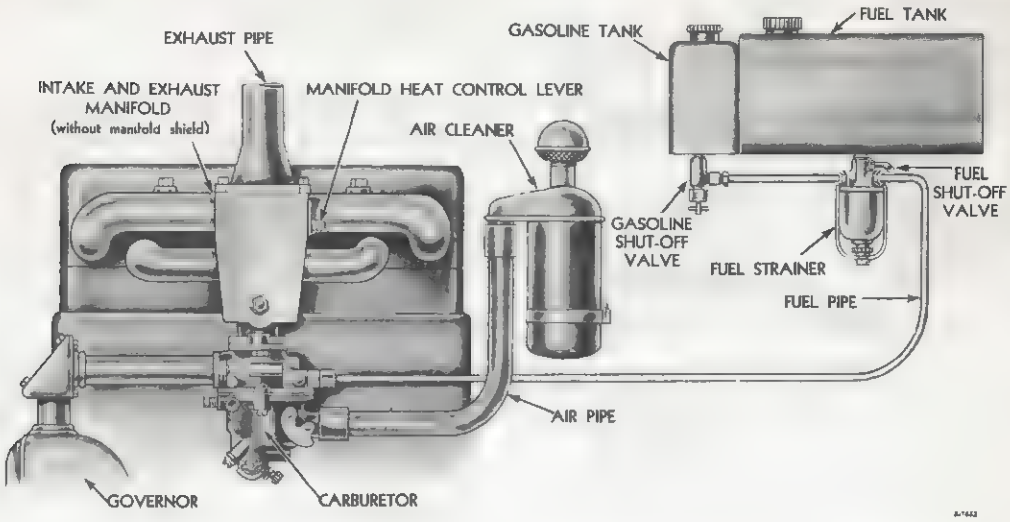
The oil filter element is a "Purolator" renewable umbrella-type giving a large filtering area. The element consists of two large accordion-folded circular sheets of impregnated creped cellulose stitched together at the edges and mounted at the center on a metal support. As shown in illust. 24A, oil entering the filter case completely envelops both inside and outside surfaces of the filter element. The oil is forced through the filtering sheets, flowing downward between them. A layer of meshed screen inserted between the filter sheets at the bottom of the element serves both to stiffen the element and to assist the flow of cleaned oil. From the outlets in the metal support, cleaned oil passes through the metering hole in the filter retaining bar and finally to the oil pan. A new element should be installed at each change of engine oil. The filter case is sealed against leakage by a copper gasket at the top on the retaining bar, and a composition gasket is inlayed in the base at the bottom of the case. A gasket is also found between the filter base and crankcase.

Crankcase Breather

The crankcase breather is incorporated in the push rod chamber side plate. An important part of the breather is a wire gauze filter element which prevents the entry of dust. This element should be cleaned or replaced at each engine tune-up. If the breather becomes clogged from neglect, leakage may occur at the crankshaft oil seals because of pressure built up in the crankcase.

FUEL SYSTEM

The fuel system consists of the fuel tank, fuel strainer, carburetor, manifold, governor, and air cleaner.



Illust. 25A--Schematic diagram of fuel system (distillate-gasoline engine) with air cleaner.

SPECIFICATIONS

Carburetor	IH model E-12
Type	Updraft
Size	1-1/4 in.
External adjustments	Low idle and load
Fuel level from bowl top	9/16 to 21/32 in.
Fuel supply, wheel tractors	Gravity
Fuel supply, crawlers, power units	Fuel pump
Manifold, for gasoline or gas	Hot spot
Manifold, for distillate or kerosene	Adjustable heat control
Muffler (except orchard)	Furnished as attachment
Manifold stud nut tension	50 ft.-lb.
Air cleaner	Oil washed wire filter
Oil cup capacity	2-1/4 to 2-3/4 pt.
Governor	IH, flyball, variable speed
Governed load speed, tractors	1450 r.p.m.
Governed load speed, power unit	1500 r.p.m.
High idle speed, tractors	1595 r.p.m.
High idle speed, power unit	1650 r.p.m.

CARBURETOR

The carburetor function is to meter the required amount of fuel to meet varying demands of engine load and speed, and distribute this fuel into the intake air stream in as fine a spray as possible. The air-fuel ratio is not constant for all loads and speeds. Idle and low speeds require rich fuel mixtures; full load, full speed operation requires slightly leaner fuel mixtures; and part load, full speed requires the leanest fuel mixtures. Modern carburetors with their air-bleed-well method of compensation will give these proportionate air-fuel mixtures to meet load and speed demands, and do not require changes in adjustment by the operator to meet varying conditions.

The Farmall-M and "6" series carbureted engines are equipped with IH model E-12, 1-1/4 inch updraft carburetor having the air-bleed-well method of compensation. Two basic types of the model E-12 are used, one for the high compression gasoline engine and one for the medium and low compression distillate and kerosene engines. The difference between these two basic types is in the size of the fuel metering openings of the jets and bleeds to compensate for the characteristics of the different fuels. These two basic types are modified for use on the crawler tractor and power unit, in which fuel pumps are used to supply the carburetor. This modification consists of a different fuel valve and seat assembly in the float chamber to withstand the higher fuel supply pressures of the fuel pump.

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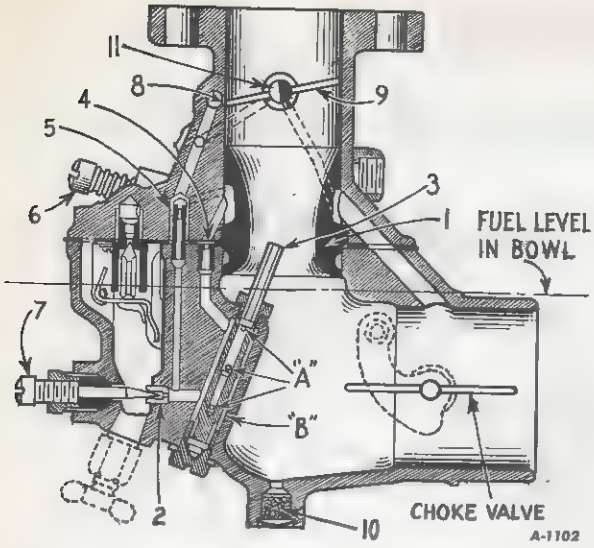


Illust. 26A--"6" series carburetor. 1. Venturi; 2. Main jet; 3. Discharge nozzle; 4. Main air bleed; 5. Idling jet; 6. Idle adjusting needle; 7. Main jet adjusting screw; 8. Idling slot; 9. Throttle butterfly; 10. Drip hole filler; 11. Economizer slot; "A"-Holes in discharge nozzle; "B"-Accelerating well.

The function of the various parts of the carburetor will be discussed by breaking them down into the following systems: Fuel supply system, idling system, load system, and choke system.

The fuel supply system of the carburetor consists of the fuel inlet strainer, fuel float, valve and seat, fuel bowl, and bowl air vent. The function of the float system is to maintain the correct level of fuel in the bowl under all operating conditions. The correct fuel level, together with the proper bowl ventilation, will insure sufficient fuel supply for good operation. The fuel bowl surrounds the discharge nozzle and accelerating well on three sides, and assists in maintaining a constant level of fuel in the metering system. The engine will operate on angles up to 20° without flooding or affecting the air-fuel mixtures.

The float assembly consists of two float bodies assembled to a double ended float lever. This construction places a float body on each side of the centralized discharge nozzle and well. Fuel from the supply tank enters the bowl through the inlet strainer and the float valve seat. When the fuel reaches the desired level it causes the float to rise and push the float valve against its seat, stopping the inflow of fuel.

When the engine is in operation, fuel flows from the bowl to the jets of the metering system and the float valve has just enough opening to maintain a constant level in the bowl. The valve opening is greater at load speeds than for idling because of the demand for a larger volume of fuel.

The bowl air vent passage is a drilling in the throttle body, connecting the bowl float chamber with a channel which surrounds the venturi. Air for the well vent, bowl vent and idling system is taken from this channel in the venturi which connects with a drilling to the carburetor main air intake. In this manner all air taken into the carburetor passes through the air cleaner. This method not only insures clean air, but creates what is called a "balanced" vent. The ratio of air and fuel in a balanced carburetor will remain approximately the same despite the condition of the air cleaner as it accumulates dirt. A balanced carburetor must have a tight seal between the fuel bowl and fuel bowl cover. Any air admitted into the fuel bowl except that which is provided through the vent passage will not only let in dirt but will upset the balance of the carburetor and affect the air-fuel mixtures.

The idle system controls the mixture at partially opened throttle for idle and slow engine speeds, until the throttle is opened wide enough to allow the main metering system to function. The idle system consists of an idle discharge slot (8, illust. 26A) located in the side of the throttle body, an idle jet (5) to meter fuel, a vacuum passage connecting the idle jet with the discharge slot, and an idle adjusting needle (6).

At idling speeds, the throttle plate (9, illust. 26A) is slightly advanced from a completely closed position leaving about one-half of the area of the idle discharge slot (8) exposed to the suction of the engine intake manifold. This suction is transmitted to the idle jet (5) and the opening past the air adjusting needle (6). Fuel from the fuel bowl flows through the main jet (2) into the metering well, up through the idle drilling from the well to the idle jet (5). As the fuel leaves the idle jet and enters the vacuum passage leading to the idle discharge slot it is mixed with a variable amount of air admitted from the opening of the idle adjusting needle. Turning the idle adjusting needle screw towards its seat reduces

the amount of air admitted and increases the suction on the idle fuel jet (5) and, hence, more fuel flows through the calibration. Turning the idle adjusting screw away from its seat increases the amount of air admitted and results in less fuel flowing from the idle jet. The reduced volume of fuel mixed with an increased amount of air forms a leaner air-fuel mixture, and vice versa.

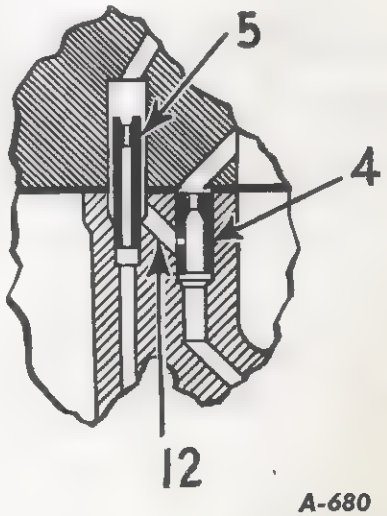
Relation of the idle system to load system. As the throttle plate (9, illust. 26A) is opened, more of the idle discharge slot (8) is exposed to the engine suction and more air passes the throttle plate. This arrangement permits the correct mixture ratio of fuel to air to be maintained at the various low speed openings of the throttle plate. When the throttle plate is opened a short distance beyond the idle slot (8), a sufficient amount and velocity of air passes the throttle plate and the main discharge nozzle (3) to draw fuel from the discharge nozzle. This condition starts the load system functioning and within this partial load range of throttle plate movement, both the idle system and load system are delivering fuel.

Further movement of the throttle plate, due to increased load, requires less fuel from the idle system to maintain an economical fuel ratio. This is accomplished by the economizer slot in the throttle shaft (11, illust. 26A) opening up an air passage from the carburetor air intake to the vacuum passage below the idle discharge port. The additional quantity of air thus added to the idle system reduces the delivery of fuel from the idle jet (5). With the throttle shaft and plate in the idling position as shown in illustration 26A the economizer air passage is closed.

The load system controls the air-fuel mixture from the partially opened throttle position to the full throttle, full load range of carburetion. It consists of the venturi (1, illust. 26A), discharge nozzle (3), main air bleed (4), metering well (B), main jet (2), and main jet adjusting screw (7).

As the throttle plate is opened past the idle position an increasing amount of air is drawn through the venturi. The velocity of the air is speeded up at the point of smallest diameter in the venturi where the outlet of the discharge nozzle is located. The effect of the venturi is to create a partial vacuum at the discharge nozzle causing fuel to be discharged. The float chamber and metering well "B" (illust. 26A), being vented, places normal pressure on the fuel causing it to flow through the main jet (2) into the metering well "B" and out through the discharge nozzle where it is delivered into the air stream.

The main jet is adjusted to meter the maximum amount of fuel necessary for full load operation. When the engine is stopped or idling, the level of the fuel in the metering well "B" (illust. 26A) and discharge nozzle (3) is similar to the level in the fuel bowl. As the load system goes into operation with increased load and throttle plate opening, the fuel is drawn from the discharge nozzle at a higher rate than supplied to the well by the main jet, thereby lowering the level of fuel in the metering well. As the load and throttle opening are increased further, the fuel level in the metering well drops below a series of air bleed holes "A" in the nozzle, admitting an increasing amount of air from the main air bleed (4). This metered addition of air to the discharge nozzle is necessary to compensate for the fact that the partial vacuum produced at the nozzle increases out of proportion with the increased velocity of air through the venturi. Were it not for the metered introduction of air into the nozzle to lean out the mixture, the proportion of fuel to air would steadily increase with the throttle opening, producing an extremely "rich" mixture at full throttle opening.



Illust. 27A--Gasoline carburetor wellreload bleed construction.

A small additional amount of fuel is necessary to insure rapid response from the engine upon acceleration. When the throttle is suddenly opened the resulting rush of air through the venturi picks up this extra fuel which remains above the main jet in the metering well at part throttle operation.

The carburetor fuel bowl as used on the high compression gasoline engine has an additional air bleed opening, the well-reload bleed (12, illust. 27A). With this arrangement the metering well "B" (illust. 26A) will be reloaded with fuel more rapidly for acceleration purposes, to care for rapid fluctuation of engine load.

The choke system consists of a manually operated choke valve mounted in the carburetor main air intake. The choke valve is used to restrict the air entering the carburetor and to increase the suction on the fuel discharge openings when starting the engine.

Under cold conditions of air, manifold, and cylinder combustion chambers it is necessary to supply a very "rich" starting mixture. Only the "light ends" or more volatile portions of the fuel can be vaporized because of the temperature and slow movement of air past the discharge nozzle (caused by low cranking speeds). The necessary large quantity of fuel is supplied by closing the choke valve during the cranking period. As the engine fires and cranking speed increases, the "rich" mixture must be rapidly reduced by opening the choke valve sufficient to keep the engine running.

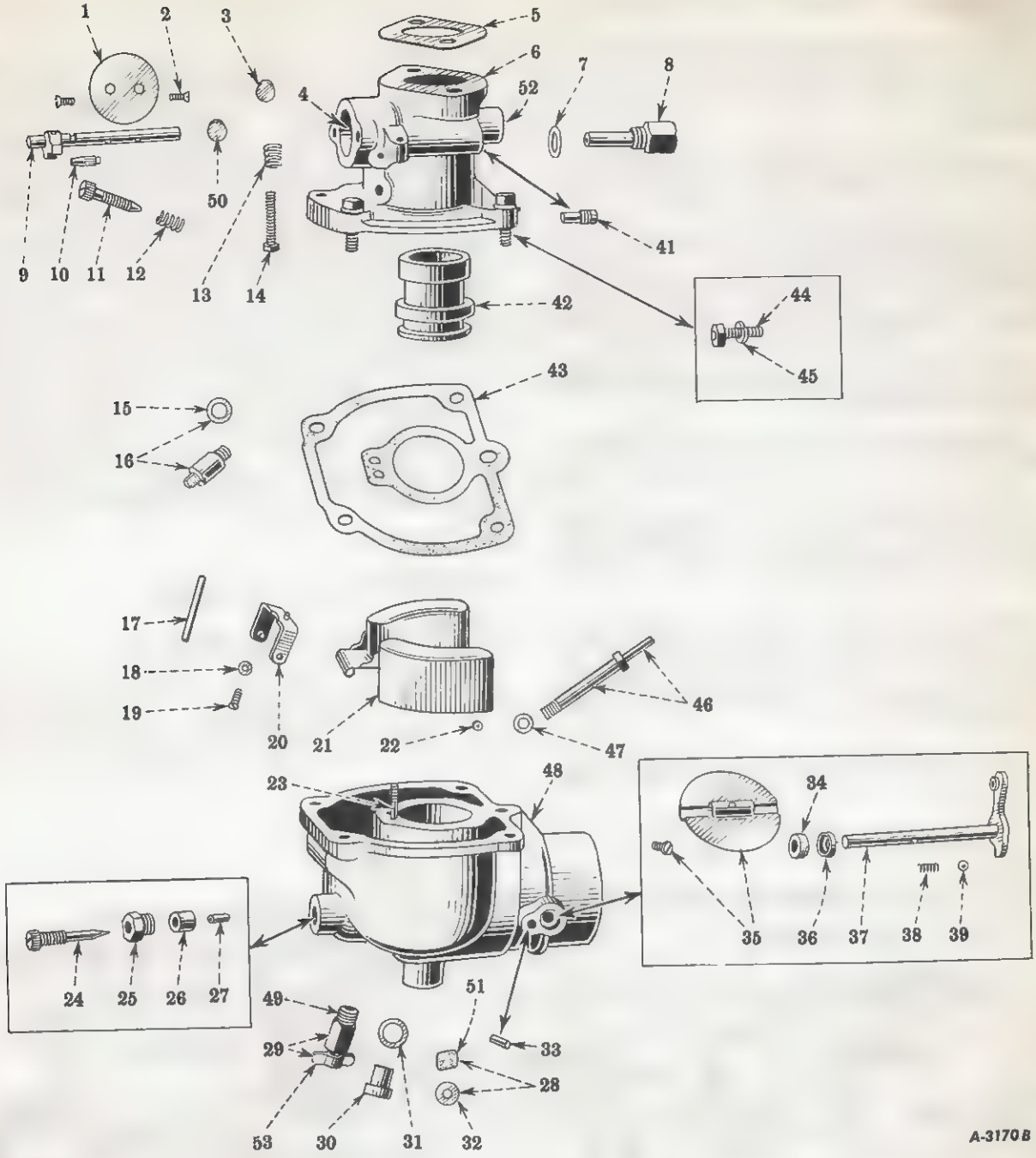
An opening is provided in the bottom of the main air intake to drain off any excess fuel which may return from the manifold. This opening is protected against the entry of dust by a filter filler (10, illust. 26A).

CARBURETOR SERVICE

Jet Identification — IH model E-12

The carburetor number is stamped on a metal identification disc attached by rivet to the throttle body.

Description	Wheel Tractors		Crawler Tractors and Power Units	
	Not High Compression	High Compression	Not High Compression	High Compression
Carburetor	47387 DB	50983 DB	53914 DA	58553 DA
Fuel bowl complete	6514 DAX	8731 DX	6514 DAX	8731 DX
Discharge nozzle	47400 DAX	56645 DX	47400 DAX	56645 DX
Main jet adjusting screw seat	45141 DA 53	56646 D	45141 DA 53	56646 D
Venturi	47407 D 27	47407 D 27	47407 D 27	47407 D 27
Idling jet	49798 D 72	49798 D 72	49798 D 72	49798 D 72
Main air bleed	35606 D 54	56647 D	35606 D 54	56647 D
Fuel float valve and seat	47396 DX 45	47396 DX 45	29302 DX 50	29302 DX 50



Illust. 29A--Exploded view of model E-12 carburetor.

Disassembly of Carburetor

Before disassembly of the carburetor the outside surfaces should be wiped free from dirt and grease so that the solvent used to clean the dismantled parts will not become contaminated.

1. Remove the idle adjusting screw (11, illust. 29A) and the retainer spring (12), using the fingers or a small screwdriver.

2. Remove the four bowl-to-throttle-body cap screws (44). Discard the fuel bowl gasket.

3. Remove the float lever pivot pin (17), which releases the float assembly (21) and fuel needle valve.

4. Remove the fuel valve cage (16) and gasket, using a wide blade screwdriver.

5. Remove the venturi (42) from the throttle barrel; this is a slip fit in the barrel held in place by the bowl assembly.

6. Unscrew the inlet fuel strainer retainer (8) and remove its gasket (7).

7. It is unnecessary to remove the throttle plate (1) and shaft (9) unless excessive wear has occurred in the bushings (4 and 52) and shaft. (See "Inspection and Assembly" following.)

8. Remove the idle metering jet (23) using a screwdriver.

9. Unscrew and remove the main jet adjusting screw (24) and drain cock (29).

10. The discharge nozzle assembly (46) and gaskets (47 and 31) are removed by unscrewing the clamp nut (30) on the outside of the bowl.

11. Remove the screw from the center of the choke valve plate (35) and slide the choke shaft (37) out of the bowl casting. This will release the friction ball (39) and spring (38).

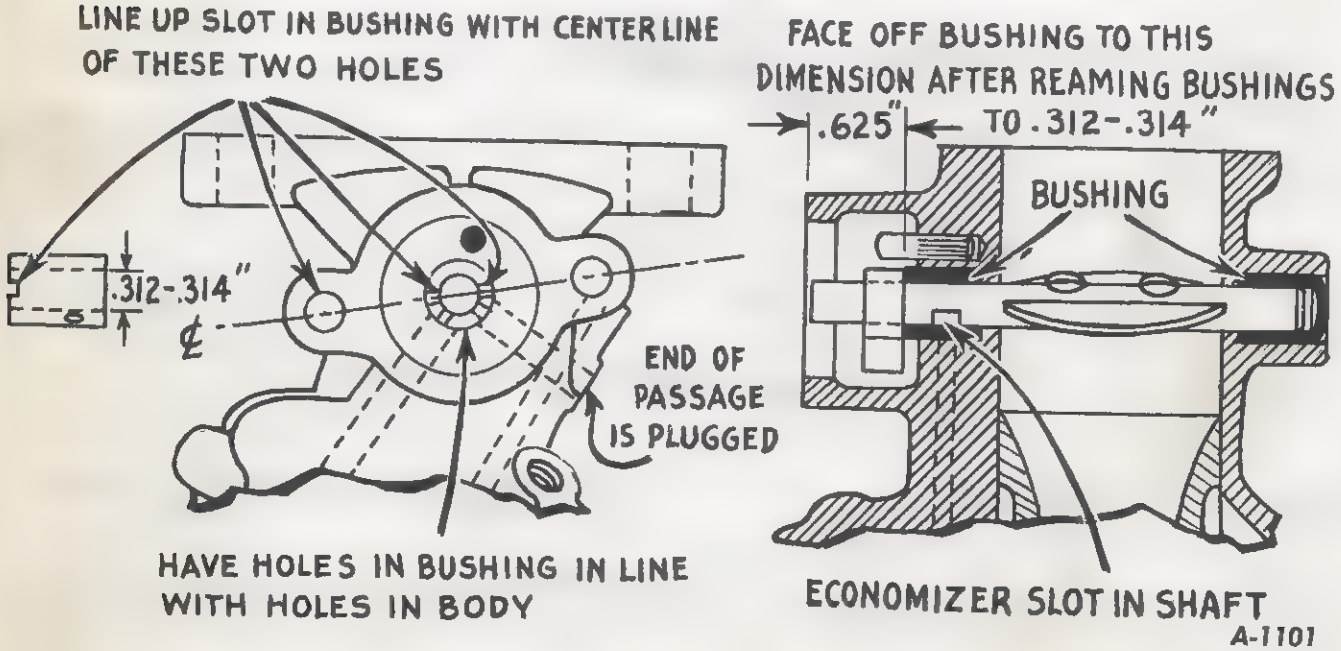
12. The choke valve dust seal (34) and retainer (36) may now be removed from the casting counterbore.

Clean all metal parts in a good solvent. Gum or varnishlike coatings from evaporated fuel are often found inside the carburetor. Such coatings restrict the flow of fuel through the jets and passages and must be removed to restore satisfactory operation. A number of good commercial gum solvents are available on the market; or a solution of half alcohol and half benzol will dissolve these gum coatings. After parts have remained in the gum solvent long enough to dissolve the coatings, remove and rinse in cleaning fluid and blow through each channel and jet opening (both directions) with compressed air to make sure channels are clear. **NOTE: Never use a wire or drill to clean out the calibrated openings in jets; use only solvent and air pressure for cleaning.**

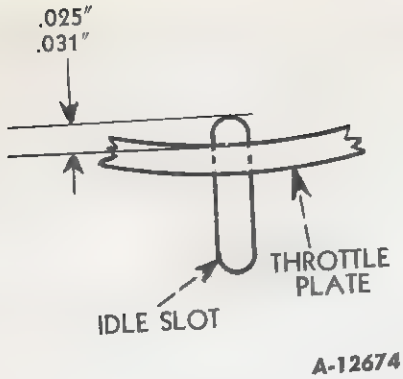
Inspection and Assembly

(a) Throttle Body and Bowl

Examine the main castings for damaged or broken flanges or badly worn shaft openings. Normal clearance between the choke shaft and bowl casting bore is .002 to .005 inch.



Illust. 30A--Diagram for installing throttle valve shaft bushings.



Illust. 31A--Diagram showing the amount of idle slot exposed above the throttle valve plate with plate fully closed.

Normal clearance between the throttle shaft and bushings is .001 to .003 inch.

Excessive wear on the choke shaft may make it impossible to seal out dirt at the lever end of shaft. Replace bowl casting if choke shaft bores are worn excessively.

Excessive wear at the throttle shaft bushings will be reflected by poor idling because of air leakage at the economizer air drillings, and by poor governor action due to a tendency to surge caused by poor alignment of the throttle plate and the idle slot. Instructions for installation of throttle shaft bushings and for facing of economizer bushing are covered in illust. 30A.

(b) Throttle Plate

Inspect the throttle plate for burrs or damaged edges. Never clean the throttle plate with a buffing wheel or sharp instrument. If throttle plate is found defective, replace it.

When replacing the throttle plate on the shaft, insert it from top of the throttle body with the short end of the throttle plate down (measured from the holes) and so that the side marked 12° will face up when the throttle is closed. Use care so that the plate is not damaged while replacing. Insert screws from the top; do not tighten until the throttle plate is centered in the barrel. Unscrew the throttle stop screw until the plate is allowed to fully close; this will aid in centering the plate. When the throttle plate is fully closed, .025 to .031 inch of the idle slot should be exposed above the plate, as shown in illust. 31A, if the barrel, plate and bushings are in good condition.

(c) Float

Replace the float assembly if the floats are loaded with fuel, damaged, or if the float axle bearing is worn excessively. Inspect the top side of the float lever for wear where it contacts the fuel valve.

(d) Float Axle

Replace the float axle if any wear can be detected on the bearing surfaces.

(e) Fuel Valve and Seat

Replace both parts if any wear can be detected on the valve needle.

Items (c), (d) and (e) are responsible for maintaining a stable and correct fuel level. Check the float height and adjust to 1-5/16 inch as shown in illust. 31B.

(f) Idle Adjusting Screw

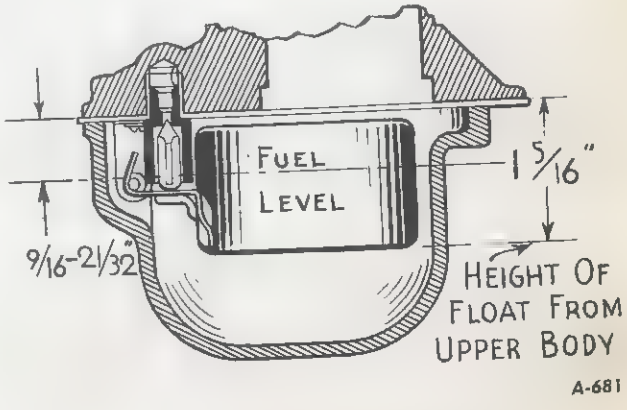
The point of the screw must be smooth and free from ridges.

(g) Main Jet Adjusting Screw

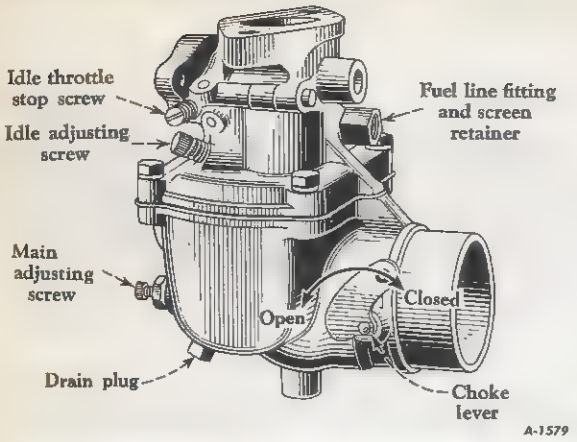
The point of the screw must be smooth and free from ridges.

(h) Gaskets

Renew all gaskets and fiber washers each time a carburetor is disassembled. Be sure all gasket surfaces are square and smooth to insure a good seal.



Illust. 31B--Float height and fuel level measurements, "6" series carburetor.



Illust. 32A--"6" series carburetor external adjustments.

(i) Shaft Packings and Drip Hole Filter

Renew the choke shaft packing and drip hole filter to prevent entry of dirt or abrasives.

(j) Venturi and Jets

Replace if damaged, particularly if the calibrated openings appear to have been damaged by probing in previous clean-operations. Use chart on page 28 for selecting part numbers for modifications of carburetor when replacing jets.

Reassembly of the carburetor may be followed in the reverse order of paragraphs 1 to 12, pages 29 and 30. Use care in assembly, to prevent damage to the float assembly. Do not force the air and fuel adjusting needles against their seats with any amount of pressure. The throttle idle stop screw may be set to hold the throttle plate slightly open.

Adjustment of Carburetor

Before starting the engine set the idle adjusting screw one turn open and the main jet adjusting screw three turns open. Do not close these adjusting screws with force enough to damage the needle or seat; turn the screws down lightly and then open the above number of turns for a starting point of adjustment.

Start the engine and operate 15 to 20 minutes to bring the operating temperatures up to normal. Change over to distillate or kerosene if the engine is to operate on these fuels and allow time for the engine to use up the starting gasoline in the carburetor and lines.

Advance the engine speed control lever to wide open position; slowly turn the main jet adjusting screw clockwise until the engine starts to miss or operate unsteadily; then turn counterclockwise until smooth operation is restored. Hold the adjusting screw in this position and tighten the adjusting screw packing nut to prevent loss of adjustment. A more accurate adjustment is made if the engine is under load.

Retard the engine speed control lever, and adjust the carburetor idle throttle stop screw to secure an idle speed of approximately 425 r.p.m. Turn the idle adjusting screw counterclockwise until the engine operates unsteadily; then turn the screw slowly clockwise until smooth operation is restored. Reset the throttle stop screw to maintain an idle speed of 425 r.p.m.

Checking Engine Problems

Good engine operation is dependent upon many factors in addition to carburetion. When diagnosing engine troubles, do not be too hasty in condemning carburetor operation.

Excessive fuel consumption may be caused by poor engine compression, faulty spark plugs, improper ignition timing or a restricted air cleaner. Also clutch slippage, traction wheel slippage, poor or insufficient lubrication of engine and chassis--all exact a toll in fuel.

When poor fuel economy is encountered it is well to inspect the entire unit operation. Check the carburetor adjustment under load, the ignition system, the brake and clutch adjustment, the amount and condition of oil in the engine, transmission and final drive. Inspect wheels for possibility of excessive slippage caused by worn lugs or insufficient wheel weights.

Thoroughly clean the air cleaner and connecting pipes to remove any possible restrictions from that source. Make sure all gaskets and connections from the air intake through the cleaner and carburetor are in good condition.

Be sure the choke valve opens fully and check the fuel lines and connections for leaks. Foreign material lodged in the fuel float valve or a worn float valve will cause a high level of fuel in the carburetor and result in poor fuel economy. A low level of fuel will cause a loss of power and rough operation; check and adjust to the measurements given in illust. 31B.

Among the various causes of hard starting are poor engine compression, slow cranking through improper lubrication, improper ignition timing, improper valve timing, improper gap adjustment of spark plugs, poor condition of spark plugs or cables, and weak output of magneto. The carburetor may be responsible because of poor choking action due to incomplete closing of the choke valve, dirt in the fuel passages or jets, or extremely low fuel level in the bowl. The operator may be at fault because of overpriming or overchoking. Be sure fuel and air lines to carburetor are unrestricted; this may require cleaning the air cleaner and fuel strainers.

Missing under load may be traceable to the ignition system because of faulty spark gap adjustment, broken insulation of spark plugs or cables, or weak output of magneto. Poor engine compression or sticking valve action are also factors. Other cases of missing may be caused by too lean mixtures due to faulty adjustments, improper float level, or air leaks at the carburetor body gaskets, manifold-to-carburetor gasket, or manifold-to-cylinder-head gasket. These gasket leaks not only cause lean mixtures but also result in excessive engine wear because of dust and grit entering the engine with the air. Foreign material such as dirt or gum formations within the carburetor jets or passages will create lean mixtures. Operating a distillate or kerosene engine without proper warm-up will cause poor performance under load.

The factors contributing to missing under load all affect power output. Also there is faulty governor operation or adjustment, overheating of the engine, or extremely rich mixtures caused by poor adjustment or leaking float valve.

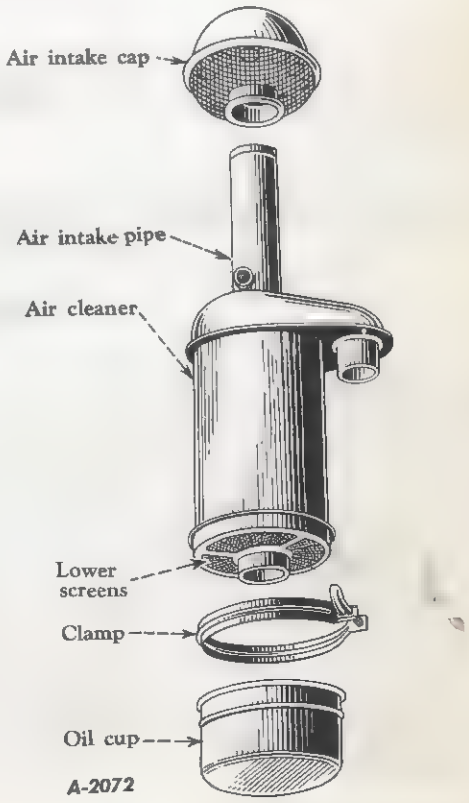
Poor acceleration of an engine may be traceable to faulty spark plug gap settings, weak magneto output or dirt in the accelerating well. However, if the engine operates properly at idle and full load speeds it indicates that accelerating well is not dirty.

AIR CLEANER

The air cleaners used on the "6" series carbureted engines are the Donaldson oil washed screen type. All are 6 inch size except on the crawler tractor and power unit which are 7 inch size. A heavy screen in the air intake cap prevents large particles of trash from entering the air cleaner. The air then passes down to the oil cup where it goes through a bath of oil. As the air passes up to the screens above the oil cup some oil is carried up with it. Fine dust in the air is removed on contact with the oiled screens. As the oil works back down from the screens, the dirt is carried with it and the dirt settles in the oil cup. To insure efficient operation the dirty oil in the air cleaner cup must be replaced each 10 hours of operation and more frequently when operating in dusty conditions. Pre-cleaner attachments are available for most models for use in these extreme dusty operations.

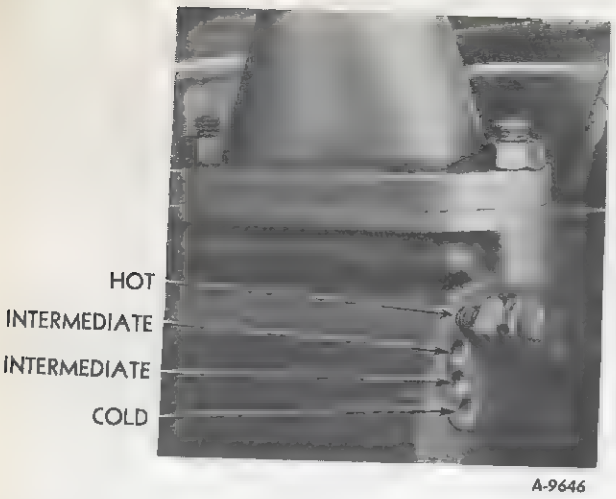
Thorough cleaning of screens and air passages after every 60 hours of operation is important in addition to servicing the oil cup. Engine overhaul or tune-up should include thorough cleaning of air cleaner and inspection of all connections for possible leakage of dirty air into the engine.

Proper functioning of air cleaner is an important factor in securing maximum power and engine life. A restricted air cleaner affects engine operation as if running with the choke valve partly closed; both result in loss of power and increased fuel consumption.



Illust. 33A--Air cleaner parts.

MANIFOLD



Illust. 34A--Intake manifold heat control.

Manifolds on the "6" series carbureted engines are single cast combination intake and exhaust manifolds. The manifold on the high compression gasoline engine does not have a heat control valve, nor is it equipped with a heat shield. Only a very small portion of the intake manifold is jacketed for heating from the exhaust. This small "hot spot" is necessary to assist in vaporizing the fuel.

The manifold on the medium and low compression, distillate or kerosene engines is equipped with a heat shield and in addition the entire intake riser is jacketed for the circulation of hot exhaust gas. An adjustable heat control valve allows the operator to adjust the intake manifold jacket temperature to meet conditions of load, air temperatures, and type of fuel used (illust. 34A).

After extended use, the inside surfaces of the intake manifold should be inspected for coke-like deposits which tend to reduce the inside diameter of the manifold; these deposits also act as an insulator preventing the transfer of heat from the jacket to the intake mixture. The deposits must be removed to improve engine operation and restore power.

Manifold gaskets must be in good condition to prevent entrance of dirt into the engine and to maintain air-fuel ratio of intake mixture. The manifold is secured to the cylinder head by six 7/16 inch studs and hex nuts. These nuts should be tightened with a tension indicating wrench to 50 ft.-lb.

EXHAUST MUFFLER

An exhaust muffler is available as a special feature on all models except orchard and grove tractors. A spark arrester attachment for the exhaust stack is also available as insurance against fire hazards from exhaust sparks.

ENGINE GOVERNOR

The engine governor used in the "6" series carbureted engine is fly-ball, variable speed type. It is designed to maintain a selected engine speed within reasonably constant limits under varying load conditions, by proportioning the fuel to the load. This governor depends for its action upon centrifugal force, developed by weights rotating about a shaft. A spring is used to counteract the centrifugal force or outward movement of the weights. The movement of the governor weights is transmitted to the carburetor throttle valve by suitable linkage.

As the engine starts and its speed increases, the governor weights move outward until the spring force and centrifugal force are balanced and the engine speed remains constant.

When a change in the engine load occurs the resulting slight change in engine speed causes a small movement (in or out) of the governor weights, which opens or closes the throttle a sufficient amount to maintain a reasonably constant engine speed.

The engine speed is controlled by the engine speed control lever increasing or decreasing the governor spring tension and not by direct connection with the carburetor throttle valve.

GOVERNOR DATA

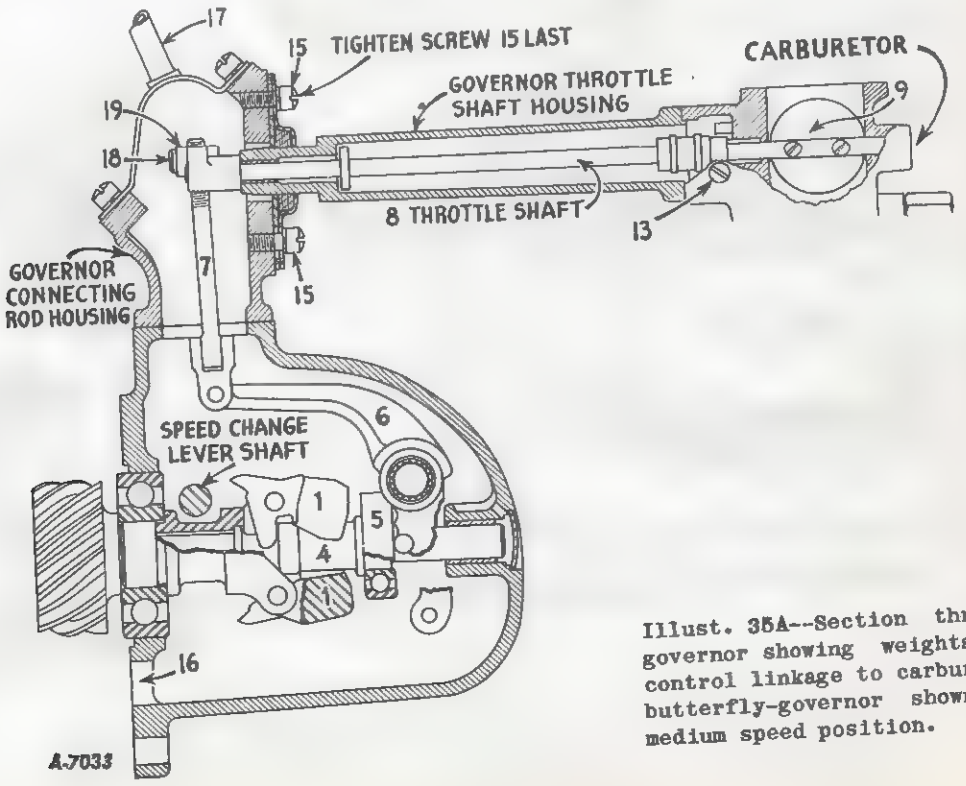
Tractor or Power Unit	Full Load Governed Speed R.P.M.	High Idle Governed Speed R.P.M.	Low Idle Speed R.P.M.	Governor Spring No.	Governor Spring Fork No.	Governor Weight No.
Farmalls M and MV W-6, O-6, OS-6 I-6, IU-6, T-6	1450 ± 10	1595 ± 25	425 ± 25	49407 DA	49406 D	45655 DA
U-6 Power Unit						
Production	1500 ± 10	1650 ± 25	425 ± 25	49407 DA	49406 D	45655 DA
Attachment	1200 ± 10	1260 ± 15	425 ± 25	57595 D	57594 D	45655 DA
Attachment . . . . . *	1800 ± 10	1980 ± 25	425 ± 25	57596 D	57597 D	45655 DA

* All power units use governor bumper spring 28078 D and spring body 53063 D.

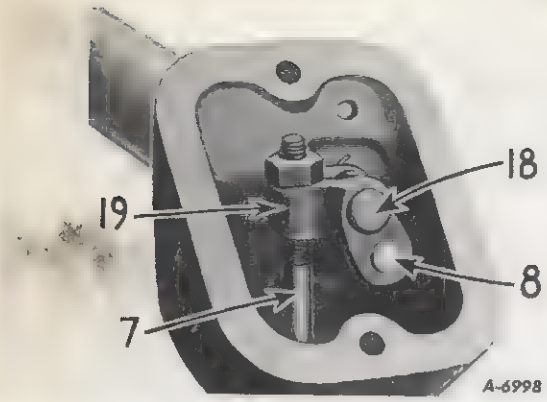
GOVERNOR SPRING IDENTIFICATION

Part No.	Working Coils	Wire Gauge	Outside Diameter	Free Length *	Length Under Load *
49407 D	9-3/4	#12 (.105)	.855 in.	2-5/8 in.	3-9/32 in. under 33.5 lb.
57595 D	12	#13 (.0915)	.8815 in.	2-7/16 in.	3-35/64 in. under 23.9 lb.
57596 D	10	#11 (.1205)	.8705 in.	2-3/4 in.	3-9/16 in. under 59 lb.

* Length from inside of hook to center of pin.



Illust. 35A--Section through governor showing weights and control linkage to carburetor butterfly-governor shown in medium speed position.



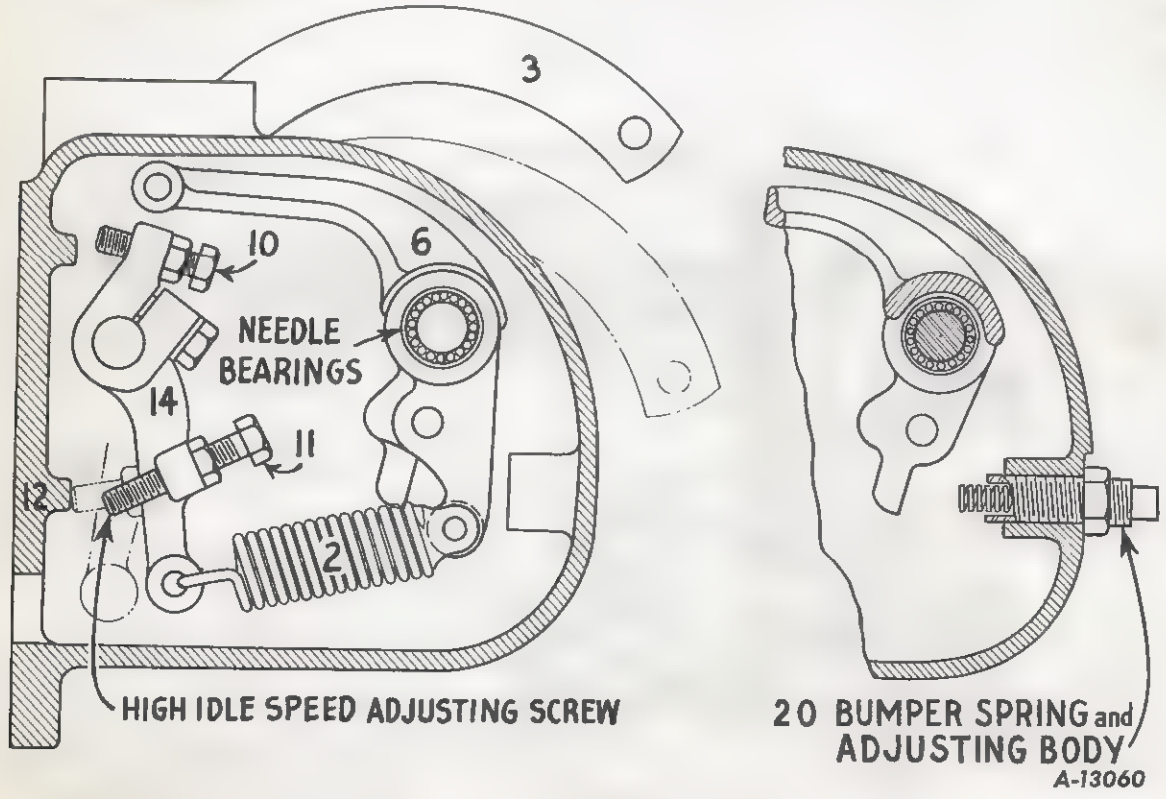
Illust. 36A--Governor throttle shaft connection.

Increasing the governor spring tension pulls the throttle further open, thereby increasing the engine speed until the added centrifugal force of the governor weights balances the greater spring tension.

Decreasing the governor spring tension allows the centrifugal force of the weights to close the throttle, thereby decreasing the engine speed until the reduced centrifugal force and the reduced spring tension again balance.

When the engine is stopped and the governor weights are at rest, with slight tension on the governor spring, the throttle plate in the carburetor should be in wide open position, parallel to the throttle barrel and against its stop.

It is very important that the linkage connecting the governor weight movement to the carburetor throttle is not worn and is correctly adjusted. This adjustment consists of synchronizing the wide open position of the throttle (9, illust. 35A) with the position of the governor weights at rest (1). To check this adjustment remove the governor connecting rod housing cover and ventilating tube (17). Set the engine speed control lever in high speed position with the engine stopped. Remove pin (18, illust. 36A) from the connecting rod adjusting block (19). Raise the throttle shaft lever (8) and the governor connecting rod (7) to the limit of their movement. With these two parts held in this position



Illust. 36B--Governor adjusting screws and springs. Parts shown in medium speed position. On the U-6 power unit (shown in right section above) the bumper spring (20) contacts the lever (6) lightly at closed throttle position.

the pin (18) should slide freely into place. If it does not, adjust the governor connecting rod adjusting block (19) on connecting rod (7) until pin holes for pin (18) line up and pin will slide in place freely. After locking the adjusting block by setting the lock nut, make sure the block is not cocked so as to bind the throttle shaft lever in any position of their movement. This movement may be checked when the engine speed control lever is placed in medium to low speed position, engine stopped.

Governor speed adjustment may be accomplished by removing the governor housing side plate. This gives free access to the adjusting screws. Screw (11, illust. 36B) controls the high idle speed. The screw (10) limits the travel of the governor spring lever (14) at the low speed end of its range. The pre-determined high idle speed (1595 r.p.m. for Farmall-M) assures the carburetor throttle plate being in a wide open position when the engine is operating at its full load governed speed (1450 r.p.m. for Farmall-M). See governor data chart, page 35.

To adjust for high idle speed the engine should first be brought up to operating temperature, after which the engine speed control lever is set to the limit of its travel at high speed. Then turn the adjusting screw (11, illust. 36B) out to increase the speed or in to reduce speed. After completing the adjustment, lock the adjusting screw by setting its lock nut.

When the throttle stop screw (13, illust. 35A) on the carburetor is adjusted for correct low idle speed (425 r.p.m.), the upper stop screw (10, illust. 36B) on the governor spring lever (14) should be adjusted to just touch its stop. At this setting the governor spring (2) should be free; it will not be possible to set the low idle speed of the engine when the screw (10) is adjusted so there is tension in the spring (2).

The linkage between the engine speed control lever and the governor speed change lever (3, illust. 36B) should be adjusted so that both stop screws (10) and (11) will touch their stops at the extremes of the engine speed control lever movement.

An additional adjustment will be found on the U-6 power unit. This is a bumper spring and adjusting body with its lock nut assembled in the rear of the governor housing (20, illust. 36B). The bumper spring body may be turned in (clockwise) to reduce surge or "hunting" at the no-load end of the range; turn in only a sufficient amount to remove the surge. If the adjustment is turned in too far it will prevent the throttle from closing to the idle position. This additional adjustment is most necessary where power units are operating electric generators and close regulation is desired.

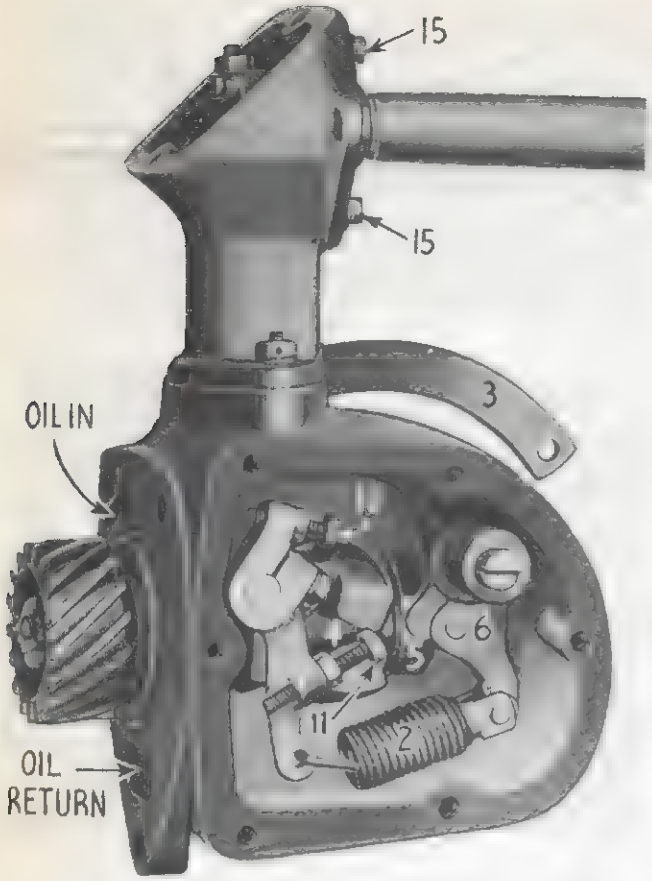
Removal of the governor assembly may be accomplished by first disconnecting the pull rod from the governor speed change lever (3, illust. 36B). Remove two machine screws from the carburetor end of the governor throttle shaft housing. Remove two machine screws (15, illust. 35A) from the governor end of the throttle shaft housing. Work the throttle shaft housing forward to release the coupling at the carburetor. Remove the connecting rod housing cover and ventilating tube (17). Remove three 3/8 inch cap screws from the crankcase front cover which secure the governor assembly to the crankcase front plate. The complete governor assembly may now be removed from the engine.

The governor shaft rotates on a ball bearing at the front and a bronze bushing at the rear of the housing. The ball bearing is provided with a snap ring so that the bearing can take end thrust from the helical gear driving the governor.

The governor sleeve bearing (5, illust. 35A) should be assembled with the wide thrust surface of the bearing away from the shoulder of the sleeve (4). The governor lever (6) is mounted on two needle type bearings. This type of construction holds friction to a minimum and results in a smoothly acting governor. All linkages should fit freely and have very little end play. Excessive end play or wear in governor parts will cause rough operation.

To prevent entry of dust into the governor housing a spring-loaded leather seal is used on the speed change shaft. The seal should be mounted in the housing with the leather lip facing outward.

When assembling the governor to the engine and carburetor, be sure the tongue and groove of the governor throttle shaft and carburetor shaft are engaged. The screws (15, illust. 35A) holding the felt



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Illust. 38A--Forward view of the governor (cover-plates removed).

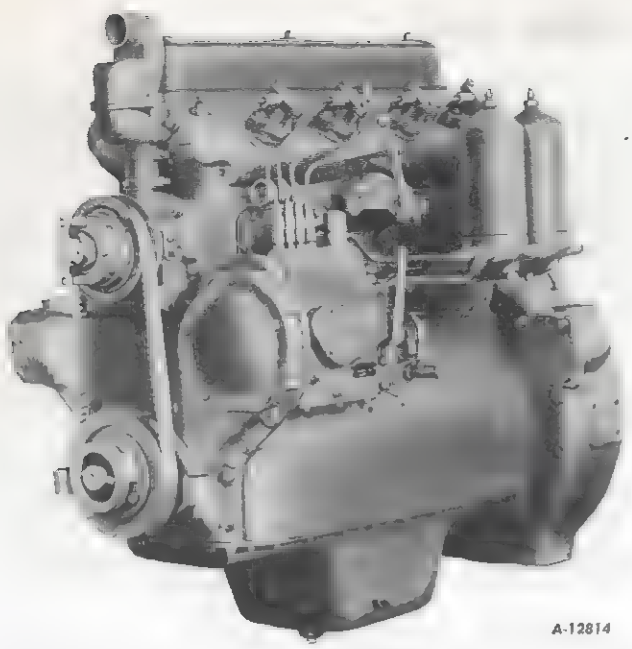
retainer to the connecting rod housing should be loose until the carburetor end of the housing is tight, then tighten bottom screw (15) and tighten top screw (15) last. Check the governor linkage for free movement; there should be no binding at any point.

If surging is encountered, check all governor linkage from the governor weights to the carburetor throttle for excessive wear or stiff movement. If the governor and its linkage are found in good condition, check the carburetor adjustment and condition. It is important for smooth governor operation that the throttle plate, when in fully closed position, aligns properly with the idling slot (refer to p. 31, (b) Throttle Plate).

Lubrication is forced to the governor housing by intermittent pressure from the engine lubrication system and returns to the crankcase front cover through an opening in the lower mounting face of the governor housing (see illust. 38A).

The governor housing is vented by a pipe (17, illust. 35A) which leads through the engine valve chamber to the air cleaner. This venting reduces condensation of moisture in the governor and throttle shaft housing. If excessive moisture is found in these housings inspect the vent pipes and air cleaner for possible obstruction.

DIESEL ENGINE



Illust. 39A--"6" series Diesel engine, left side.

SPECIFICATIONS

Number of cylinders	4
Type cylinder	Replaceable, special alloy, dry liner
Bore and stroke	3-7/8 x 5-1/4 in.
Displacement, per revolution	247.7 cu. in.
Compression ratio	14.2 to 1
Full load governed speed	
All tractors and IUD-6	1450 r.p.m.
UD-6 power unit	1500 r.p.m.
High idle governed speed	
All tractors and IUD-6	1610 r.p.m.
UD-6 power unit	1665 r.p.m.
Minimum governed speed	900 r.p.m.
Low idle speed	450 r.p.m.

DESCRIPTION

The "6" series Diesel engine is a 4 cylinder, 4 cycle, valve-in-head engine operating on low priced fuel and on less fuel than carbureted engines of the same size doing the same amount of work.

All IH Diesel engines are temporarily converted to run on gasoline for starting, making them as easy to start as carbureted engines of comparable size. It takes less than a minute warm-up period to convert them to Diesel operation. When the change-over is made, the spark plugs, carburetor, and auxiliary combustion chambers used on the gasoline cycle are shut off and have no connection with the Diesel operation. Burning gasoline inside the same cylinders which are later used for Diesel operation warms the engine in the quickest, most thorough way possible and the engine speed is fast enough to take full advantage of compression heat when the change-over to Diesel operation is made.

The fuel injection system is of advanced design, consisting of the IH single plunger injection pump and fuel injectors. Injection is controlled by the single injection pump plunger insuring uniform injection to each cylinder through distributor valves and uniform timing of the start of each injection.

A sensitive centrifugal type governor acts directly on the injection plunger, metering the fuel according to load demands. This sensitive governing, plus uniform injection, produces equal power from all cylinders and results in smooth operation, lugging ability, and low fuel consumption.

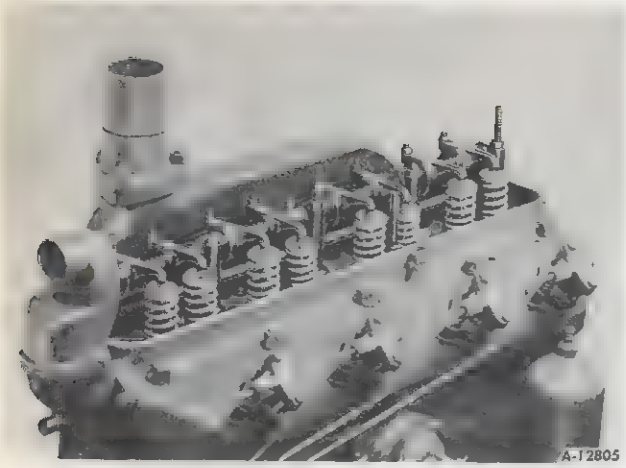
Engine lubrication is accomplished by oil pump pressure through drilled passages to all working parts. The oil pump is equipped with a floating type intake screen, taking only clean oil above the sediment level in the oil pan.

Removable dry liner cylinder sleeves of special alloy insure long life and inexpensive renewal when replacement is necessary. Tocco hardened crankshaft bearing surfaces and heavy duty precision bearings of the replaceable type are also a feature.

The engine valve housing and injection pump housing are ventilated through a pipe connected to the intake air cleaner to hold moisture condensation in these enclosures to a minimum. The engine is protected against dust and abrasive material by an efficient oil type air cleaner, and an oil filter having a large replaceable filtering element. Efficient seals are used at all shaft openings to prevent unnecessary wear of engine parts caused by the entry of abrasive dust. Undue wear of the fuel injection pump is prevented by use of sediment traps, screens, and large area fuel filters against the entry of dirt with the fuel.

The various parts of the engine are discussed and service methods are outlined in the sections which follow.

CYLINDER HEAD



Illust. 40A--"6" series Diesel engine valve assembly. Note the starting valve shaft below valve lever shaft.

Specifications

Stud diameter	1/2 in.
Stud nut tension	110 ft.-lb.
Valve guides, replaceable; service guides reamed to size.	
Height of valve guide above spring seat counterbore:	
Intake and exhaust	31/32 in.
Starting	7/16 in.
Valve seat angle	45°
Valve seat width:	
Intake and exhaust	3/32 in.
Starting	3/64 in.
Valve port diameter:	
Intake	1-1/2 in.
Exhaust	1-1/32 in.
Starting	7/8 in.

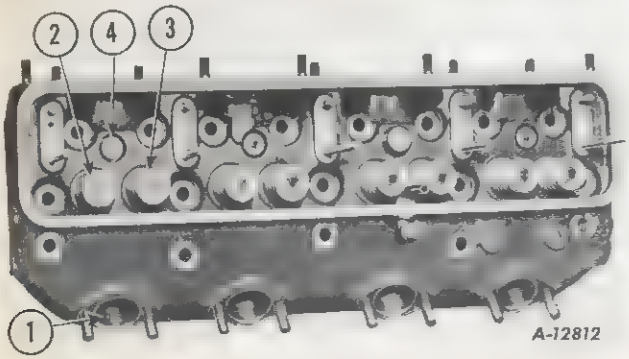
Valve Guides

Valve guides are replaceable. Service guides are furnished reamed to give .002 to .004 inch clearance between valve guide and valve stem. Broken, burned, cracked or worn valve guides should be replaced. When installing new guides, care should be taken to prevent damage to the top edge of the guide bore during the pressing operation. Service guides are identified by a groove on the outside diameter of the upper end of the guide. Press in from the top of the cylinder head to the following dimensions: Measuring from the top of the guide to the bottom of the spring seat counterbore on top of the cylinder head, the intake and exhaust valve guides should be 31/32 inch, and the starting valve guide should be 7/16 inch.

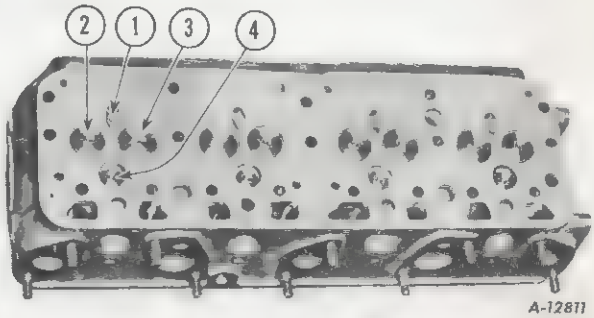
A true valve seat cannot be obtained when valve guides are worn excessively. The valve guide bore should be concentric with the valve seat within .002 inch. Examine all guides and valve stems for wear before regrinding valves.

Valve Seats

Valve seats in the head are 45° angle; the finished seat after regrinding should be 3/32 inch wide for intake and exhaust and 3/64 inch wide for the starting valve. The seats should contact the approximate center of the valve face. Before refacing the valve seats, worn valve guides



Illust. 40B--Top of cylinder head (valve levers and shaft removed). 1. Injection nozzle mounting port; 2. Exhaust valve; 3. Intake valve; 4. Starting valve.



Illust. 40C--Under side of cylinder head. 1. Opening from precombustion chamber and injection nozzle; 2. Exhaust valve head; 3. Intake valve head; 4. Starting valve head, closing off the auxiliary combustion chamber, used for starting only.

should be replaced to insure true seats and prevent the removal of more seat material than necessary.

When replacing the cylinder head, the use of a new head gasket is good insurance against leakage and lost time involved replacing a re-used gasket. The proper use of a good torque indicating wrench prevents distorting the cylinder walls and valve seats, which might otherwise occur if a cylinder head is tightened unevenly. The sequence of head nut tightening begins at the center of the head and continues back and forth across the head toward each end.

VALVES

Specifications

Type	Poppet
Location	In cylinder head
Valve head diameter	
Intake	1-23/32 in.
Exhaust	1-17/32 in.
Starting	31/32 in.
Valve stem diameter	
Intake and exhaust	.371 in.
Starting	.309 in.
Valve lift	
Intake and exhaust	.500 in.
Starting	.220 in.
Valve material	
Intake	MD-3140
Exhaust	Sil. No. 2
Starting	Sil. No. 2
Valve lever clearance (engine hot)	.017 in.
Starting valve (closed) cam clearance	.060 to .080 in.
Valve lever shaft diameter	.872 to .873 in.
Valve lever bushing length	1-3/16 in.
Valve lever bushing to shaft clearance	.002 to .004 in.
Valve spring free length	
Intake and exhaust	2-11/32 in.
Test	49 lb. compressed to 2-1/16 in.
Starting	1-31/32 in.
Test	24 lb. compressed to 1-5/32 in.
Valve timing (plus or minus 5°)	
Valves open	
Intake	10° before TDC
Exhaust	42° before BDC
Valves close	
Intake	30° after BDC
Exhaust	10° after TDC

In removing valves from the cylinder head, do not compress the valve springs any further than is necessary to remove the keys or retainers. Clean and inspect valves before refacing. Valves having excessive stem wear, bent stem, or with the head burned, warped, or ground down to a thin edge, should be discarded. Those found fit for re-use may be refaced and the end of the stem squared. Most valve refacing machines have a fixture for regrinding the stem ends. Grooved or worn stem ends tend to crowd one side of the valve stem guide, increasing the wear at this point. The uneven surface also makes it impossible to secure accurate valve lever clearance adjustment.

Valve Springs

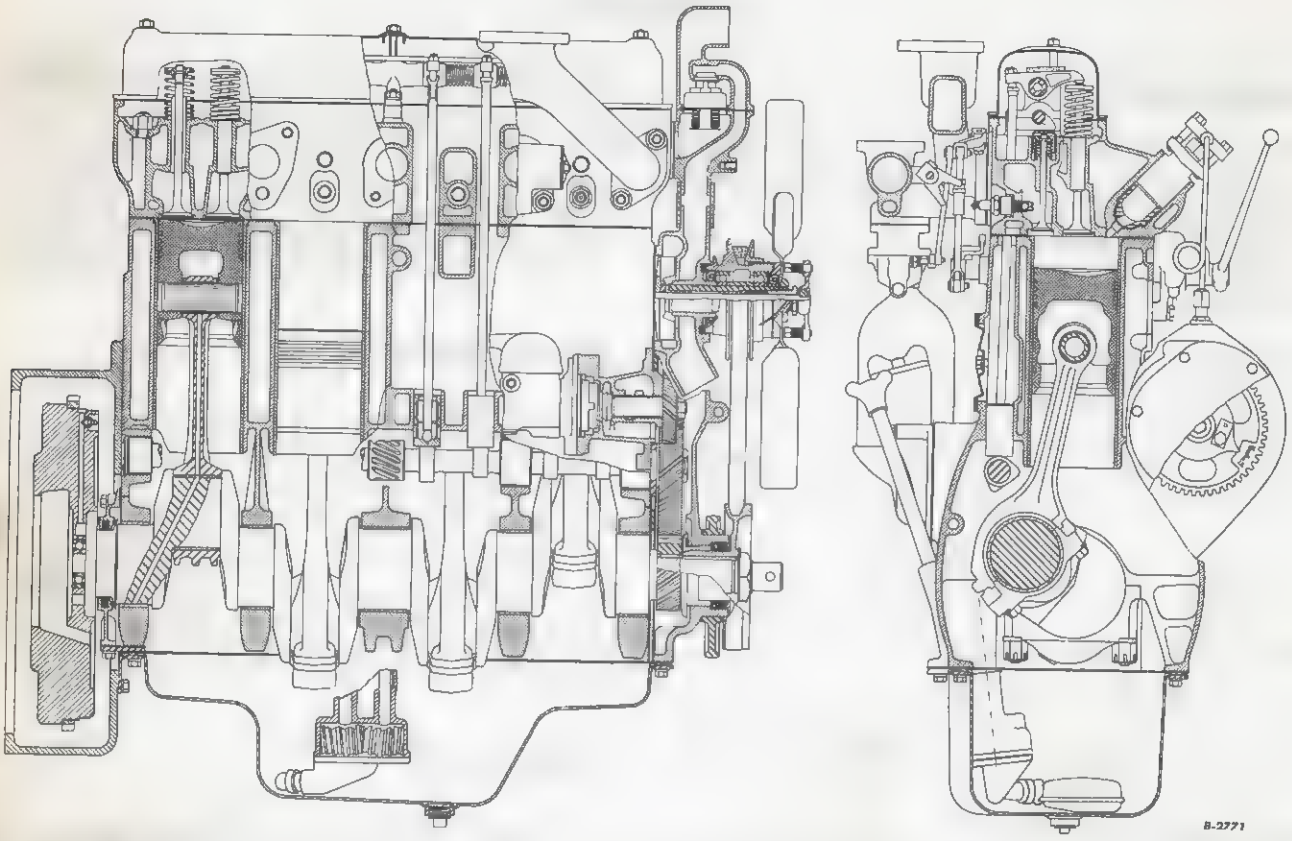
Valve springs are the same for intake and exhaust valves; a lighter spring is used on the starting valves. Springs showing rust pits, distortion or cocked condition, or lack of proper tension should be replaced. The construction of the springs is such that either end may be assembled toward the cylinder head. When installing do not compress more than is necessary to replace the keys or retainers.

Valve Levers

Valve levers are lubricated by pressure from the engine lubrication system. A slot in the front bearing surface of the camshaft allows a metered flow of oil to pass up to the drilled valve lever shaft. Bushings in the valve levers are replaceable and must be reamed to size after being pressed into the lever, to allow a shaft clearance of .002 to .004 inch. Each valve lever has an oil bleed drilling which feeds a small amount of oil into a groove leading to the lever adjusting screw and push rod socket. On the exhaust valve levers this oil groove also extends to the valve stem end of the lever.

For exhaust and intake, right and left-hand valve levers must be properly assembled with the brackets on the shaft so that each lever lines up with its valve. When wear occurs at the valve stem contact face of the valve levers, they may be refaced if not worn through the hardened surface. Most valve re-

facing machines are equipped with an attachment for refacing the valve levers. It is important that this face of the valve lever is in good condition. A worn face may place a side thrust on the valve stem and also makes it impossible to obtain an accurate valve lever adjustment. The clearance between the valve lever and valve stem should be adjusted to .017 inch while the engine is at normal operating temperature. This may be accomplished with the engine operating at low idle speed or by turning the engine to the top dead center of the compression stroke for each cylinder and adjusting the valve lever clearance of each cylinder in firing order (1-3-4-2).



Illust. 42A--Sectional views of Diesel engine with power unit, flywheel and housing.

PISTON AND SLEEVE ASSEMBLY

Specifications

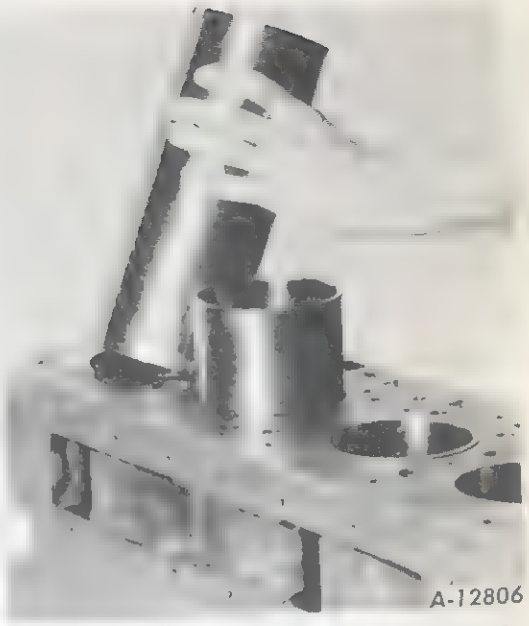
Piston material ..... Aluminum alloy*
Skirt clearance in sleeve . .0055 to .0065 in.*
A 1/2 inch wide, .005 inch ribbon gauge may be used as a "GO" gauge with a light pull of 2 to 4 pounds. A .006 inch ribbon may be used as a "NO GO""gauge with a tight pull of 11 to 14 pounds.
Compression rings
No. 1 (top) plain face, width ..... 3/32 in.
No. 2 plain face, width ..... 1/8 in.
No. 3 taper face, width ..... 5/32 in.
No. 4) Oil regulating, width ..... 1/4 in.
No. 5)
Ring gap ..... .010 to .020 in.
Clearance in groove
No. 1 (top) compression ring ..... .004 in.
Remaining four ..... .003 in.
Piston pin (full floating)
diameter ..... 1.3125 to 1.3128 in.
Piston pin retainers ..... Snap rings
Pin tight in alloy piston (.0001 to .0003 in.) at 70° F.; hand press fit at 160 to 180° F.
Pin clearance in rod bushing .0003 to .0005 in.
Cylinder sleeve material ... Heat treated alloy
Sleeve type ..... Dry liner
Sleeve bore ..... 3-7/8 in.

*Because of material shortage during war years, many engines were equipped with grey iron pistons fitted in sleeves with a measured clearance of .0045 to .0055 inch.

Cylinder Sleeves

Cylinder sleeves are the dry liner, replaceable type, selective fitted in production to pistons to give normal measured clearances as listed in specifications. Fitted sleeve and piston assemblies are available for service, singly or in weight matched sets of four, and require no honing or boring after assembly. Mark sleeves and their mated pistons so that upon assembly the same sleeve and piston will operate together.

Puller SE 1213 is available for removal of cylinder sleeves from the crankcase block. The bore of the block must be thoroughly cleaned before new cylinder sleeves are inserted. Abrasive material is NOT to be used in this cleaning process. Coat the outside of the new sleeve with a light film of clean oil for ease of assembly. Where necessary, a wooden block held squarely across the top of the sleeve may be used to pull the sleeve into the bore. The top of the sleeve should project .041 to .047 inch above the top of the crankcase block when in place. The engine need not be removed from the tractor or unit to perform this operation (see illust. 43A).



Illust. 43A--Dry liner replaceable cylinder sleeves.

Piston Rings

Piston rings are available for service in two types, standard production type and compensating type. Where pistons and cylinder walls are new or where only slight wear has occurred it is advisable to use standard production rings. Where piston and cylinder wall wear is within certain limits, engine performance with satisfactory oil control can be secured by use of compensating ring sets.

Satisfactory results can be expected from compensating ring set installations in "6" series engines where eccentric (egg shaped) wear of the cylinder walls does not exceed .0037 inch and tapered wear does not exceed .0155 inch as measured at the extremes of ring travel; and when piston and top ring grooves do not show more than .006 inch clearance as measured between the side of the groove and a new ring, using a feeler gauge. If wear exceeds these limits, new pistons and cylinder sleeves should be installed.

Piston and connecting rod assemblies are removable through the top of the cylinder bore on "6" series engines.

If a ridge has been worn in the cylinder wall at the upper end of the ring travel, this ridge must be removed with a ridge reamer before the pistons are removed. This prevents damage to piston ring lands during removal of pistons and also damage to new top position rings after installation of new rings.

Piston ring grooves and oil drain holes must be cleaned thoroughly before new rings are mounted on the pistons. Care should be used in the cleaning process to prevent damage to the sides of the ring lands.

Check all rings for gap openings by placing rings squarely in lower portion of cylinder bore and measuring the gap with the feeler gauge. After checking the gaps mount the rings in their respective grooves as outlined in the instruction sheets packed with the rings. Do not spread the rings beyond the amount necessary to slip over the piston; a distorted ring is of little value.

All other factors contributing to oil control of the engine must also be checked and corrected when new rings or piston and sleeve assemblies are installed. Connecting rod alignment must be checked; valve guides must be in good condition; the camshaft, crankshaft and their bearings must be in good condition; and external leaks corrected by use of new gaskets and seals.

Piston Pins

Piston pins are full floating type retained in the piston by a snap ring at each end of the bore. Before removing piston pins from new aluminum alloy pistons, heat the pistons in 160° to 180° F. water at which temperature the pins are a light hand press fit. Follow the same procedure when mounting the piston on the rod. This heating of the piston makes it unnecessary to use force in removing or installing the pins and prevents damage or distortion of the pistons.

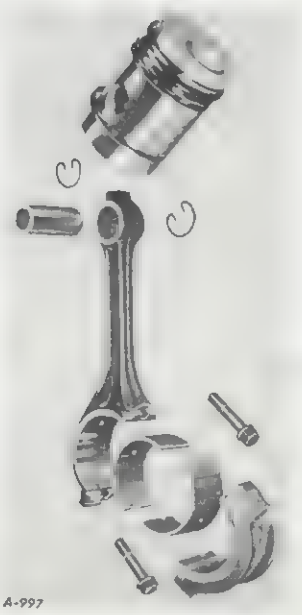
An oversize pin (.005 inch) is available for service. The piston bore and connecting rod bushing should be reamed or honed to give the fit listed in specifications. After installing new piston pins the connecting rods must be checked for proper alignment to insure parallel contact of piston and cylinder wall.

Piston tops are stamped with the word "FRONT." This point must be assembled toward the front or timing gear end of the engine. See the section following for further information.

CONNECTING RODS AND BEARINGS

Specifications

Rod type	Heat treated forged I-beam
Distance between bearing and bushing centers	10 in.
Crank bearing	Replaceable precision type
Material	babbitt lined bronze on steel
Length	2-3/32 in.
Shaft diameter	3.2480 to 3.2485 in.
Side clearance on shaft	.003 to .010 in.
Diameter running clearance	.0023 to .0033 in.
Piston pin bushing	Replaceable
Material	Bronze
Length	1-1/2 in.
Pin diameter	1.3125 to 1.3128 in.
Diameter running clearance	.0003 to .0005 in.
Number of bolts per rod	2
Bolt size	1/2 in.
Nut tension	85 ft.-lb.
Bearing cap, angle of split	35°



Illust. 44A--TD-6 connecting rod assembly.

Installing Connecting Rod and Bearings

Connecting rods are stamped with the cylinder number on both the cap and rod, number one starting at the front (timing gear end) of the engine. The numbered sides of the rod and cap are installed toward the camshaft.

Illust. 44A shows the Diesel connecting rod assembly complete with piston, rings, piston pin, retaining snap rings and bearings. Note the cupped section of the piston head; this must be assembled on the opposite side from the numerical markings on the connecting rod. The top of the piston is stamped with the word "FRONT." This point must be assembled toward the front (timing gear end) of the engine. By assembling the piston to the connecting rod as mentioned, and assembling connecting rod to engine with the stamped numbers toward the camshaft side, there will be no doubt of properly locating the piston. It is very important that the piston be assembled properly since the cupped section of the piston head lines up directly with the opening from the precombustion chamber in the cylinder head.

The connecting rod and piston assemblies are removed and installed from the top of the crankcase bore. This is made possible by the 35° split of the rod and cap.

The connecting rod bearing running clearance may be checked by placing a

.003 inch brass shim (1/4 x 2 inches) lengthwise between the lower bearing surface and the crankshaft. If the clearance is not excessive, there should be a slight drag when turning the crankshaft with the spark plugs removed and the engine set for the starting cycle.

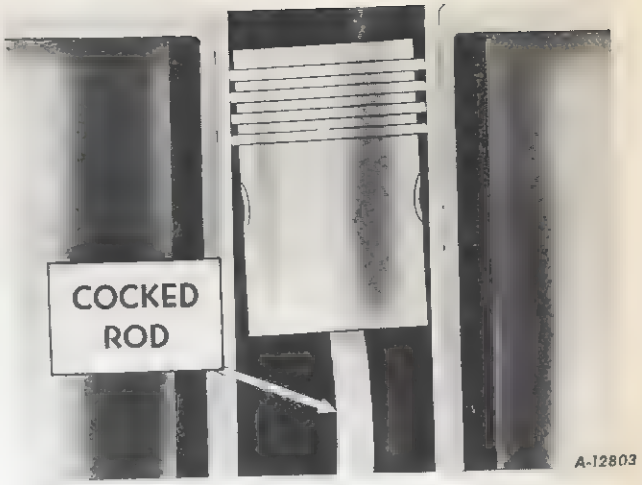
"Tri-metal" bearings are used. The bearing surface is a coating of Babbitt (.005 inch) over bronze, with a steel back. Bearings are not adjustable; when clearance is excessive the bearings must be replaced. Under no conditions should any attempt be made to file rods or caps to tighten bearings. Connecting rod bearings are available in .003 inch undersize for use on crankshafts with a small amount of wear, and for the reground "exchange" crankshafts a .030 inch undersize bearing is used.

When installing connecting rod bearings, be sure the oil passages in the rod and crankshaft are open and clear. A rifle barrel brush and air blow gun are useful in thoroughly cleaning such passages. Bearing backs and rod surfaces must be absolutely clean, smooth, and free from oil. Any foreign material between the bearing back and rod will distort the bearing and prevent uniform clearances. Bearings have a nib or projection which prevents turning of the bearing within the rod. This projection must engage the milled notches in the rod and cap.

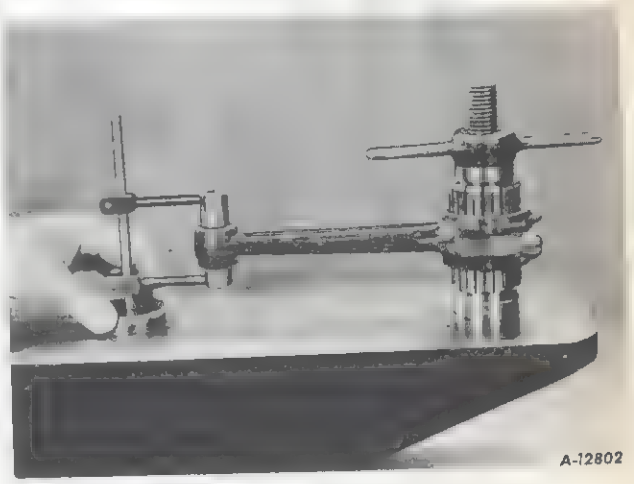
The piston pin bushing in the connecting rod is lubricated by a drilled passage from the rod bearing. When installing the pin bushing the oil hole in the bushing should line up with the oil passage in the rod. Bushings must be reamed or honed after being pressed in place to give .0003 to .0005 inch clearance on the piston pin. This is a light hand push fit.

Connecting Rod Alignment

Proper alignment of the connecting rod bearing in relation to the piston pin and piston skirt is most important. Cocked or twisted rods will prevent the piston and rings from contacting the cylinder wall squarely, which will result in oil being pumped up past the rings. When rods are badly misaligned, a knock may develop caused by the rod striking the piston boss. This indicates the rod is offset toward the front or rear. Many



Illust. 45A--Bent connecting rods prevent rings from making proper contact with cylinder walls.



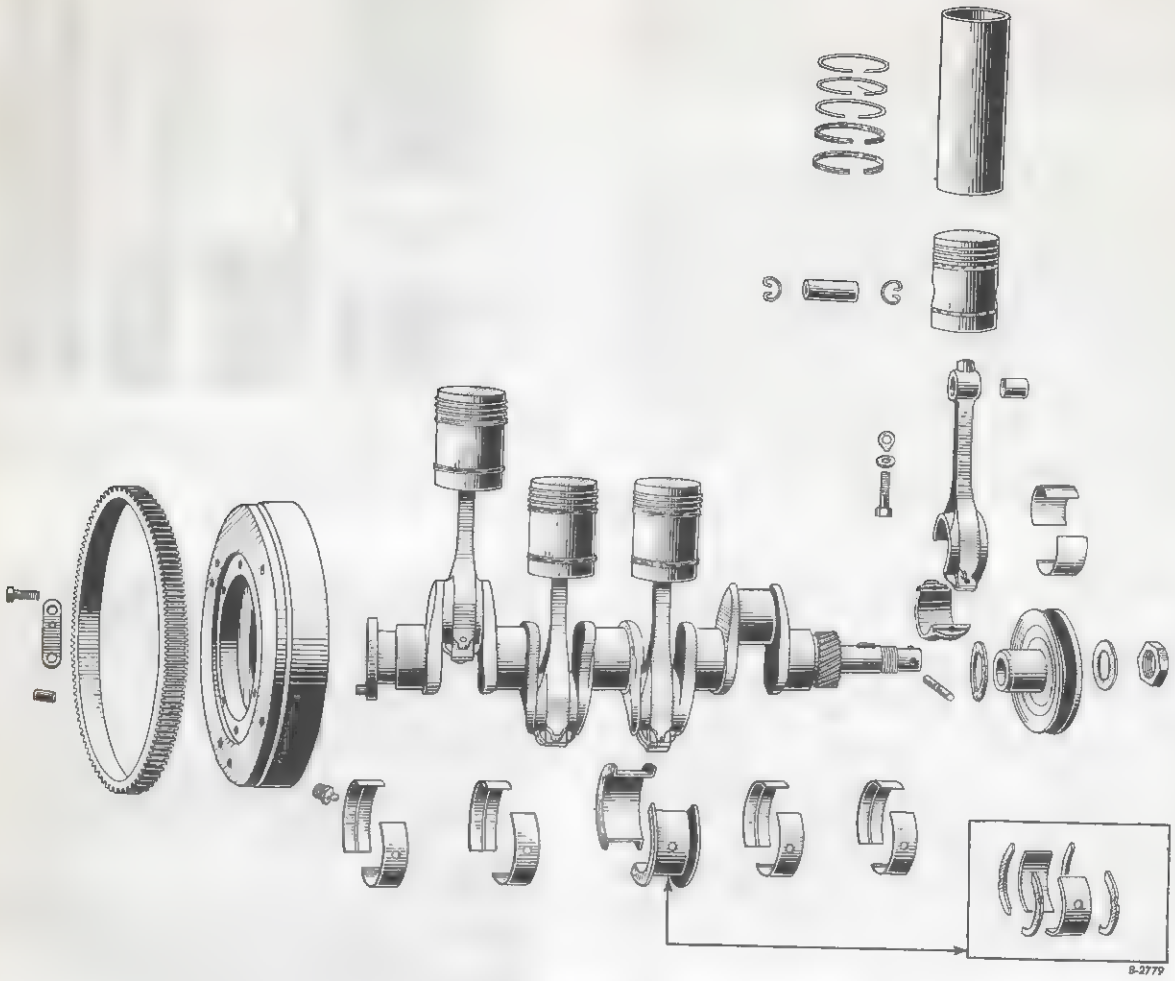
Illust. 45B--Fixture and method of checking connecting rod alignment.

cases of excessive oil consumption have developed after new rings, pins or new piston and sleeve assemblies have been installed, because of neglect to check and correct the alignment of connecting rods.

Misalignment of connecting rods may be caused by engine overloads, detonation, or in the replacement of piston pins, where pin bushings may be reamed out of parallel with the rod bearing.

The use of a good torque indicating wrench will prevent distortion of connecting rod bearings and also prevent placing undue strain on connecting rod bolts. Rod bolts are locked by bending the lock washer over the hex flat.

CRANKSHAFT AND BEARINGS



Illust. 46A--Crankshaft and related parts.

Specifications

Crankshaft material	MD 1745 forged steel
Length, over-all	33-7/32 in.
Weight	99 lb.
Bearing surfaces	Tocco hardened
Number of main bearings	5
Type	Precision
Material	babbitt lined bronze on steel
Length, front	1-3/8 in.
Length, intermediate	1-3/8 in.
Length, center, thrust	2-1/4 in.
Length, rear	1-3/8 in.
Running clearance	.0027 to .0037 in.
End clearance	.004 to .008 in.
Bearing journal diameter.	3.748 to 3.7485 in.
Bearing cap stud diameter ... (8)	5/8 in.
(2 center)	3/4 in.
Bearing stud nut tension ... (8) ..	125 ft.-lb.
(2 center)	150 ft.-lb.
Flywheel bolt diameter	1/2 in.
Flywheel bolt tension	65 ft.-lb.

Crankshafts of the "6" series Diesel engines have Tocco hardened bearing journals and are drilled for pressure lubrication of connecting rod bearings. Each main bearing cap is numbered to correspond with a number stamped on the camshaft side of the crankcase. The studs used to secure the center main bearing cap to the crankcase are 3/4 inch diameter; all other bearing cap studs are 5/8 inch diameter. A torque indicating wrench should be used in tightening the bearing cap nuts to prevent distortion of the caps or crankcase.

The precision type main bearings are not adjustable, and should be replaced when running clearances become excessive. This running clearance may be checked by placing a .003 inch brass shim (1/4 x 1-1/4 inches) lengthwise between the lower bearing surface and crankshaft. If clearance is not excessive, there should be a slight drag when turning the crankshaft on the starting cycle with the spark plugs removed.

Check the end clearance with a feeler gauge at the front side of the center main bearing on both the upper and lower thrust faces, being sure the crankshaft is being held against the rear thrust face of the bearing, to show total clearance at the front side.

In an emergency, the crankshaft bearings may be replaced without removing the crankshaft from the case, but extreme care must be taken to insure cleanliness of the bearing backs and crankcase bearing bore. These surfaces must be absolutely clean and dry when installing new bearings. Small particles of dirt left between the bearing shell and the crankcase bore will distort the bearing, reducing the running clearance at localized point and the frictional heat thus produced results in the bearing material being melted loose from the steel backing at that point. Such melted material lodging between the bearing surface and shaft at other points, creates other hot spots, until often complete bearing failure results. Anything which interferes with the running clearance or heat dissipation of a bearing has its effect on the bearing life.

To remove the upper half of a main bearing with the crankshaft in place, insert in a crankshaft journal oil hole a cotter pin, or its equivalent, which has the rounded head flattened to form a "T" and then rotate the crankshaft to push out the bearing. The bearing cap and bore are milled to receive the projection on the back of the bearing; the projection end is removed first. When replacing, rotate the shaft so the projection enters last.

The replacement of crankshaft main bearings without removing the crankshaft should be done only in an emergency. When these bearings are worn sufficiently to require replacement or have failed through lack of lubrication, the entire crankcase and its oil distribution bores should be thoroughly cleaned. This cannot be accomplished without the removal of the crankshaft. The crankshaft front and rear oil seals should also be replaced. This cleaning of the crankcase and replacing of oil seals is the best insurance against early bearing failures through dirt or foreign material left in the crankcase oil distribution bores or from dirt entering worn crankshaft oil seals.

Crankshaft main bearings are available in standard sizes .003 inch undersize for a shaft only slightly worn, and .030 inch undersize for use with the reground "exchange" crankshaft. One defective main bearing will require the replacement of all five bearings; otherwise crankshaft "lay" or alignment cannot be maintained.

Oil Seals

Oil seals are provided at the front and rear of the crankshaft. The front seal is combination felt and leather, located in the crankcase front cover; assemble with the felt portion of the seal toward the outside. The rear oil seal is a split type felt; the flywheel must be removed to replace this seal. When an oil leak occurs between flywheel and crankcase, check the fit of the expansion plug (2-1/8 inch) at rear of camshaft; also check the rear main bearing for excessive wear, and replace all gaskets, and felt of the rear oil seal.

Flywheel

The flywheel is secured to the crankshaft flange by four 1/2 inch diameter heat treated bolts. These should be tightened evenly by using a torque indicating wrench. Tighten to 65 ft.-lb. and lock with metal lock strips.

CAMSHAFT AND BEARINGS

Specifications

Camshaft material	Forging steel, wearing surfaces carburized and hardened
Length, over-all	26-5/32 in.
Type of drive	Helical spur gear
Number of teeth in gear	54
Bearing journals	4
Front journal	2.4305 to 2.4315 x 1-13/32 in.
2nd journal	2.3055 to 2.3065 x 1-13/32 in.
3rd journal	2.1805 to 2.1815 x 1-13/32 in.
Rear journal	1.8680 to 1.8690 x 1-1/16 in.
Bearing material	Steel-backed, Babbitt
Running clearance	.0015 to .0035 in.
End clearance	.002 to .010 in.
Thrust plate material	Steel
Lubrication	Pressure
Service bearings	Finished to size

The camshaft of the "6" series Diesel engines is mounted in four replaceable, steel-backed Babbitt bearings, which are pressed into the crankcase. These bearings when furnished for service are finished to proper size and do not require reaming after installation.

End clearance is limited by a retaining thrust plate assembled between the front bearing journal and the drive gear. The rear bearing bore in the crankcase is sealed from oil leakage into the flywheel housing by use of an expansion plug (2-1/8 inch). The engine oil pump is driven from a gear cut directly in the camshaft. The magneto is driven by the camshaft drive gear.

The camshaft is removed by first removing or raising the valve tappets to clear the largest diameter of the shaft; second, removing the oil pump complete, and by removing the two 3/8 inch cap screws from the camshaft retaining thrust plate. These cap screws may be removed through openings in the drive gear. This allows camshaft to be removed from front end of crankcase.

After worn bearings are removed from the crankcase, care should be taken to clean the bores and remove any burrs or sharp edges which would distort the new bearings upon installation.

The new bearings may be pulled into the crankcase by use of a bolt and heavy washers. One side of the washers must be trimmed a sufficient amount to center the bolt in the bearing to prevent cocking. Or new bearings may be driven in by use of a punch with a heavy plate next to the bearing. When in place, the forward end of the four bearings should be flush with the front faces of their respective bores, and the oil holes properly lined up.

TIMING GEARS

Specifications

Crankshaft pinion	27 teeth
Camshaft gear	54 teeth
Magneto gear	27 teeth
Injection pump gear	54 teeth
Idler gear	41 teeth
Type of teeth	Helical

With the crankcase front cover removed, the timing gear train is accessible. The crankshaft pinion drives only the idler gear; the camshaft gear and fuel injection pump drive gear are driven from the idler gear; the starting magneto is driven from the camshaft gear. All five gears must be properly meshed to have engine timed correctly.

The crankshaft pinion has a single punch mark on a tooth which must line with a single punch mark between the teeth of the idler gear.

The idler gear also has two punch marks on a tooth which line with two punch marks between teeth of the injection pump gear. A third marking on the idler gear consists of two punch marks on a tooth which lines with two punch marks between teeth of the camshaft gear.

A single punch mark between teeth of the camshaft gear lines with a single punch mark on a tooth of the magneto drive gear.

The idler gear has a bronze bushing and revolves on the idler shaft. The idler shaft is secured to the engine crankcase by a 1/2 inch cap screw and a dowel pin. Lubrication to the idler shaft, camshaft thrust plate and timing gears is furnished by pressure from the front camshaft bearing.

The magneto, camshaft and crankshaft gears are a press fit on their shafts, proper position being secured by Woodruff keys. When removing or installing these gears be sure no pressure is placed on the helical gear teeth which would damage or distort the teeth resulting in a noisy gear train.

The timing of the magneto and timing of the injection pump are described in the sections covering starting system and fuel system.

ENGINE LUBRICATION SYSTEM

SPECIFICATIONS

Type	Pressure system
Pump (all except TD-6)	Single stage, helical gear
Pump (TD-6 only)	Single stage plus auxiliary
Drive	Gear driven from camshaft
Body gears, clearance in body	.006 to .0075 in.
Body gears, end clearance	.003 to .005 in.
Body gears, teeth backlash	.003 to .006 in.
Oil intake	Floating screen
Pressure regulator valve	In oil filter base
Valve type	Piston
Valve diameter	.900 to .901 in.
Valve diameter clearance	.004 to .006 in.
Valve spring free length	3-49/64 in.
Test	42 lb. when compressed to 2-3/32 in.
Oil pressure at governed speed	60 to 70 lb.
Oil filter, replaceable element.	"Umbrella" type
Filter material	Impregnated cellulose
Replacement interval	100 hours
Crankcase oil capacity	9 qt.

DESCRIPTION

The engine lubricating oil is taken from the oil sump through a floating screened intake to the pump. This floating intake takes oil from near the surface of the oil in the pan, thus sediment or dirt which may have accumulated in the bottom is not picked up to be circulated by the pump. The floating intake is pivoted from the oil pump cover and must be free to move up and down. The oil pump used on TD-6 crawler tractor is provided with an auxiliary set of pump gears, which return oil from the shallow front end of the pan back to the sump, when the tractor is operated at extreme angles.

Oil from the pump is delivered to a drilled passage or gallery running the length of the crankcase on the right side and connecting with the oil filter base. Pressure in the oil distribution lines produced by the pump is controlled by a spring-loaded regulator valve in the oil filter base. A portion of the oil delivered to the filter passes through the filter element, the amount limited by a metering outlet opening in the filter retaining bar. This cleaned oil is returned to the oil pan as is the oil that is by-passed by the pressure regulator valve.

From the same drilled passage or gallery to which the filter is connected, oil passes to the camshaft and crankshaft main bearings. Drillings in the crankshaft lead from the main bearing journals to the connecting rod bearings. The connecting rods are drilled to deliver oil to the piston pin.

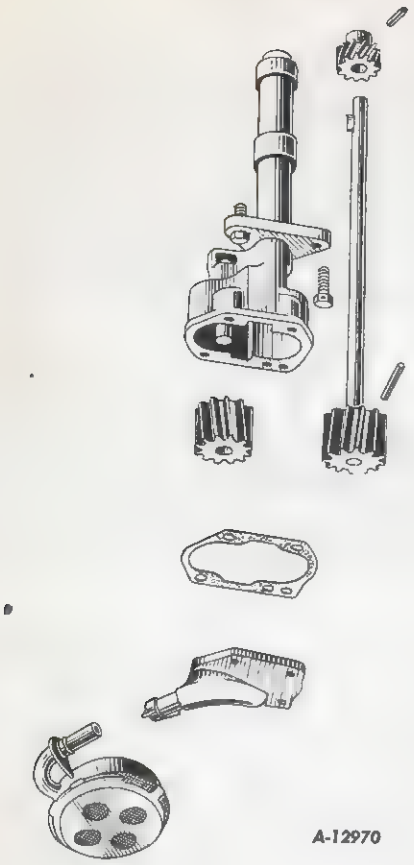
A slot in the front camshaft bearing journal meters oil each revolution, up through a passage to the cylinder head to the hollow valve lever shaft. This lubricates the valve levers and starting valve shaft. A valve oiler pad over the valve levers is kept saturated with oil from drilled holes in the top of the valve levers. As oil drips from the valve levers and pad it is drained back to the sump through the push rod openings lubricating the valve tappets and cams on its way down.

The idler timing gear shaft is lubricated through drilled passages in the crankcase connecting with the front camshaft bearing. Oil is metered to this passage by the slot in the camshaft front journal. A drilling in the front journal of the camshaft lubricates the camshaft thrust plate. Oil thrown off from the pressure lubricated bearings lubricates the timing gears and magneto drive shaft.

OIL PUMP

The oil pump is secured to the crankcase by two 7/16 inch cap screws and lock washers, and is driven from a spiral gear which is a part of the camshaft. The oil pump drive shaft extends down from the spiral driven pinion through the oil pump body to the base which incloses the two oil pump body gears, one of which is keyed to the drive shaft; the second body gear is an idler. Gaskets are used between the pump body and cover to secure the necessary end clearance of the body gears.

The oil pump used in the engine of the TD-6 crawler tractor is similar to the above description, with the addition of an auxiliary set of pump gears and housing which is assembled between the main pump body and the pump cover. The drive shaft and idler shaft are longer, extending through the auxiliary gears. Oil taken through the main floating screen passes up a tube directly to the main pump gears, and into the distribution gallery. Oil taken in through the auxiliary intake tube is delivered by the auxili-



Illust. 50A--Exploded view of oil pump for Diesel engine.

Illust. 50B--Exploded view of oil pump with auxiliary gear and inlet pipe for crawler tractor only.

ary gears to the pump cover, up through the hollow idler shaft and discharged through an opening in the body above the idler shaft. In this manner oil picked up at front of oil pan, when operating at extreme angles, is returned to oil sump to insure a constant supply of oil to engine.

To disassemble the oil pump, remove the four 3/8 inch cap screws and locks from the body cover. Remove the body cover and thoroughly clean all parts. Inspect the idler shaft and gears and drive shaft and gears for wear. Check the running clearance between the gear diameters and the body; using a feeler gauge, also the end clearance between the gears and body cover. Gaskets of .006 inch normal thickness are used between the body and cover to adjust this end clearance. In the TD-6 crawler tractor, pump gaskets are provided between the auxiliary housing and the main body for end clearance adjustment of main gears, and between auxiliary housing and cover for adjustment of end clearance of auxiliary gears. If it becomes necessary to replace one or both gears on the pump drive shaft, care must be taken to prevent springing the shaft while pressing the gears in place.

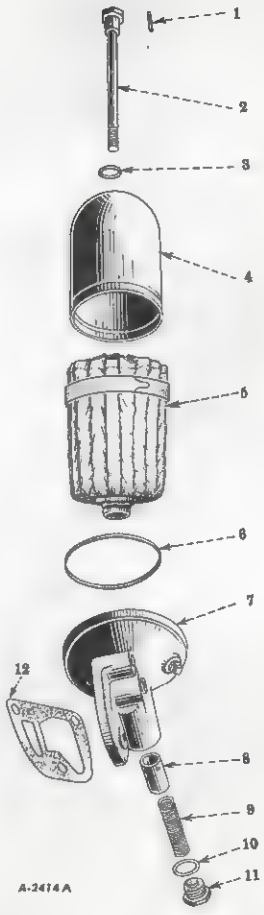
Running clearance, end clearance, and back lash of the body gears are the important factors in maintaining the output of the oil pump. Replace worn parts to bring clearances back to normal as given in the specifications. When reassembled the pump should operate freely, without binding.

The oil filter and oil pressure regulator valve are contained in the same housing, mounted on the right-hand side of the crankcase. The normal output of the oil pump is many times the normal requirement of the engine lubricating system and all the oil supplied by the pump cannot escape through the engine bearing clearances and metered passages. The spring-loaded regulator valve (8, illust. 51A) is employed to release the excess oil and maintain a pressure of 60 to 70 pounds at full engine speed. This piston type valve and its spring (9) may

be inspected by removing the retainer nut (11) and gasket (10) from the front side of the oil filter base (7). The valve should slide freely in the bore of the filter base. The spring should be straight so that the valve will not be cocked in the bore or on its seat. The free length of the pressure regulator valve spring will give some indication of its condition; however, the best test to determine the spring tension is to load it with the weight specified and measure its length at that load. If this tension length test is below specifications, the spring should be replaced.

OIL FILTER

The oil filter element is a "Purolator" renewable umbrella type giving a large filtering area. The element (5, illust. 51A) consists of two large accordion-folded, circular sheets of impregnated creped cellulose stitched together at the edges and mounted at the center on a metal support. Oil entering the filter case completely envelops both inside and outside surfaces of the filter element. The oil is forced through the filtering sheets, flowing downward between them. A layer of screen mesh inserted between the filter sheets at the bottom of the element, serves both to stiffen the element and to assist the flow of cleaned oil. From the outlets in the metal support, cleaned oil passes through the metering hole in the filter retaining bar (2) and finally to the oil pan. The filter case (4) is sealed against leakage by a copper gasket (3) at the top and a composition gasket (6) is inlayed in the base (7) at the bottom of the case. A gasket (12) is also assembled between the filter base and the crankcase.

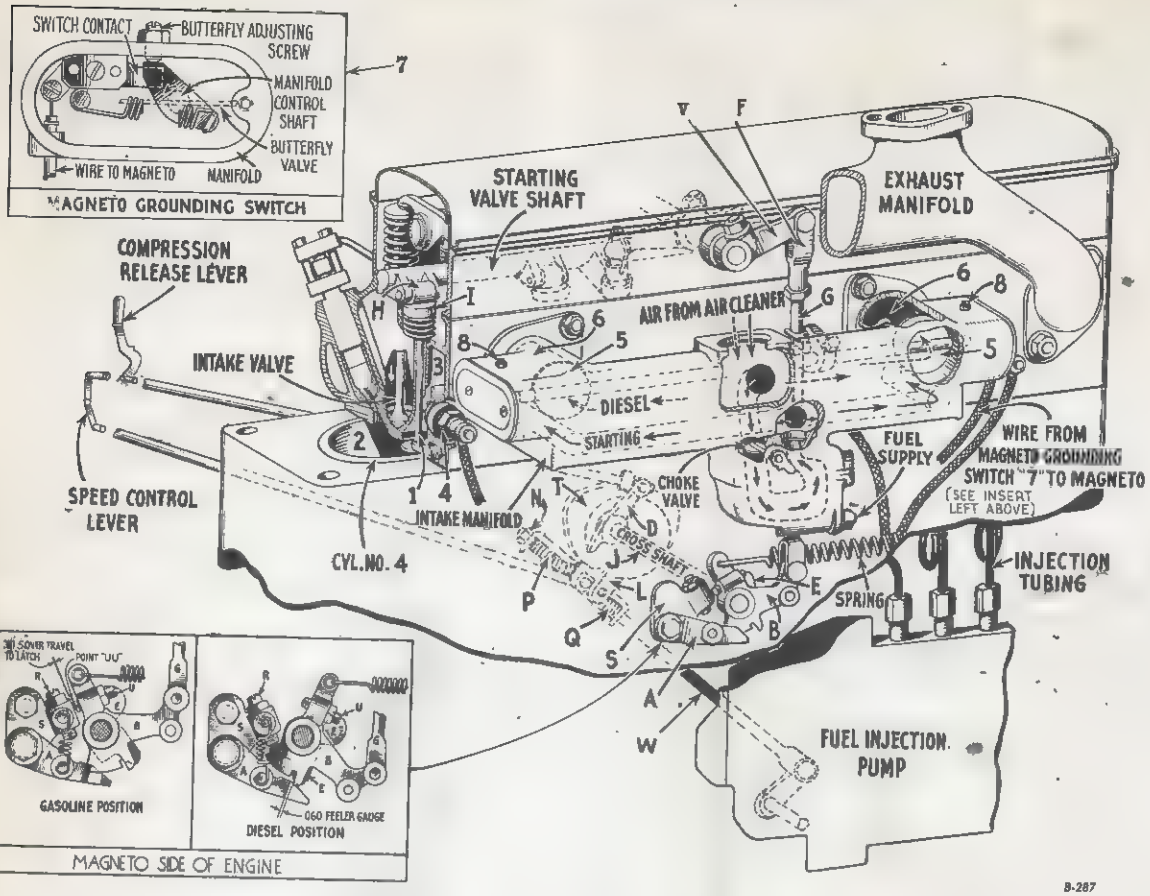


Illust. 51A--Exploded view of filter and pressure regulator valve.

CRANKCASE BREATHER

The crankcase breather is incorporated in the push rod chamber rear cover plate. An important part of the breather is a wire gauze filter element which prevents the entry of dust. This element should be cleaned or replaced at regular intervals. If the breather becomes clogged from neglect, the resulting pressure built up in the crankcase may cause oil leakage at the crankshaft oil seals.

DIESEL STARTING SYSTEM



Illust. 52A--Engine starting system.

SPECIFICATIONS

Magneto	IH model H-4
Rotation	Counterclockwise
Breaker point gap	.013 in.
Impulse coupling trips	6-1/2° after T.D.C.
Spark advance	15°
Magneto drive gear, helical teeth	27
Spark plug size	18 mm., 7/8 in. hex
Spark plug gap	.020 to .025 in.
Firing order	1-3-4-2
Starting valve normal lift	.220 in.
Starting valve (closed), cam clearance	.060 to .080 in.
Carburetor fuel level	13/32 to 7/16 in.
Float below bowl top	9/32 in.
Air valve opening	3/32 to 7/64 in.
Intake manifold	Dual type
Manifold stud nut tension	50 ft.-lb.

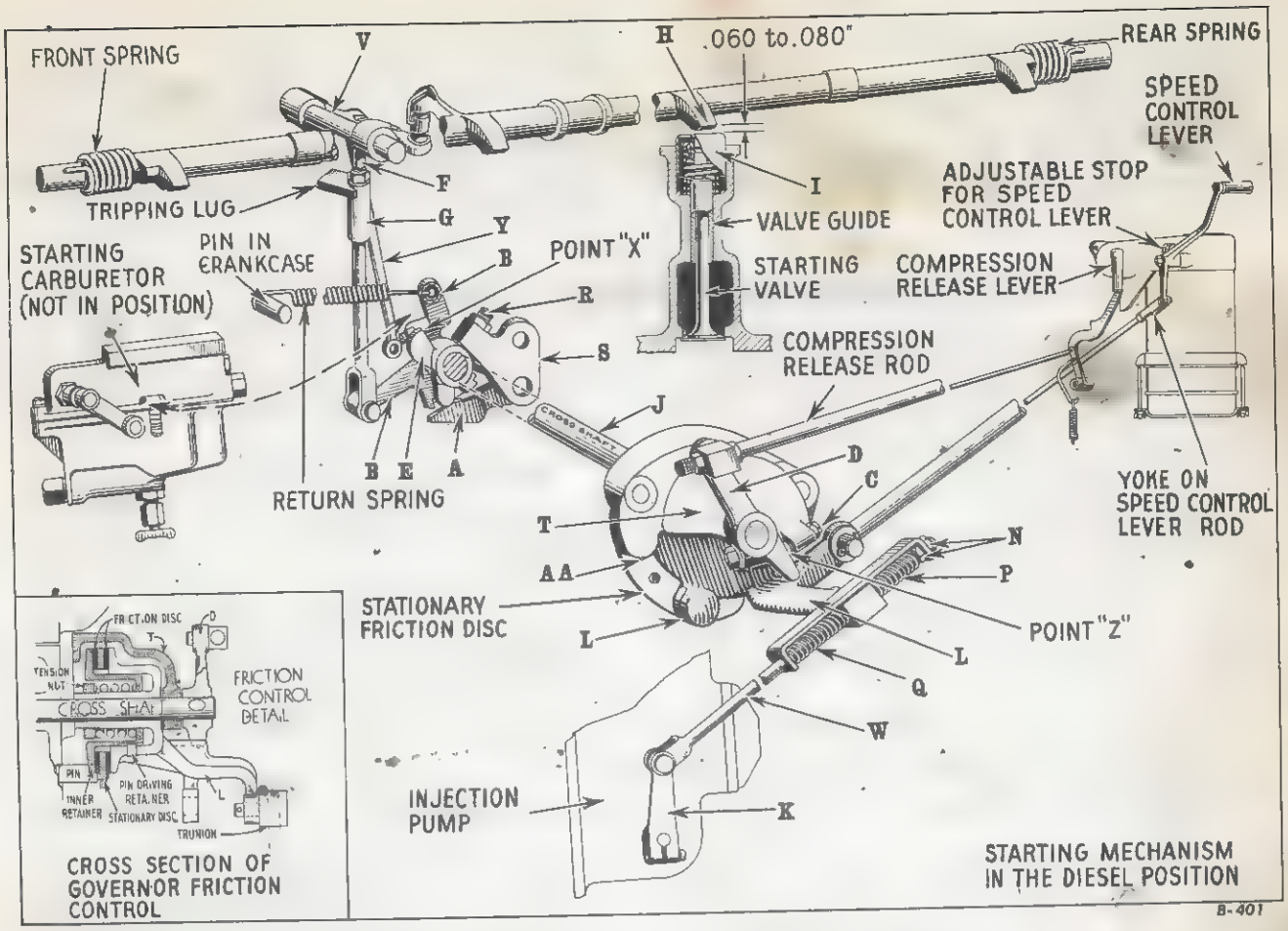
DESCRIPTION

The "6" series Diesel engine starts on gasoline like a regular spark-ignition engine. This is accomplished by means of a starting mechanism which controls four starting valves in the engine head, two butterfly valves in the dual intake manifold, a magneto grounding switch and a shutoff valve in the carburetor.

To start the engine as a conventional gasoline engine, pull down the speed control lever all the way (see illust. 53A). This prevents the fuel injection pump from delivering fuel to the nozzles even though the engine is running. Next, the compression release lever is pushed down until jaw "B" locks with latch "A."

Pulling the compression release lever back accomplishes four things:

1. It opens four starting valves (1, illust. 52A) thereby enlarging the combustion chamber (2) by volume (3) in which spark plug (4) is located. This reduces the compression ratio to that of a conventional gasoline engine, or about 6.4 to 1.



Illust. 53A--Starting control mechanism and governor friction control.

2. It closes the two butterfly valves (5), shutting off the Diesel air-intake passageway. The intake air then must pass down through the carburetor, and then through the manifold to the intake ports in the cylinder head. The air-gasoline mixture enters a cylinder on the suction stroke of the piston, is compressed on the upward stroke, and ignited by the spark plug in the low-compression chamber.

3. It connects the magneto electrical circuit by opening the magneto grounding switch located in the front end of the intake manifold.

4. It releases the shutoff valve in the carburetor fuel bowl allowing the needle to be actuated by the float.

The engine is then started in the normal way by hand cranking or with an electric starting attachment. After the engine has operated on gasoline for about a minute the operator pushes the compression release lever all the way forward and raises the engine speed control lever to the operating position at the same time. The engine then runs as a full Diesel.

Raising the compression release lever depresses latch "A" (illust. 53A) causing it to release jaw "B." Jaw "B" is actuated by a return spring which causes it to turn pulling down rod "G." This movement opens the butterfly valves, closes the starting valves, locks the carburetor needle valve on its seat, and closes the magneto grounding switch. While engine operates on Diesel cycle, carburetor, magneto, spark plugs, and low compression chambers are inactive.

The engine is equipped with a governor friction control (cross-sectional drawing shown on insert in illust. 53A) which is part of the starting mechanism. It is located on the cross shaft "J" just below the bracket "T." Its purpose is to prevent any play in the control linkage from interfering with speed regulation and also holds the governor control lever "K" at the speed selected.

The friction control consists of the lever "L" which can turn freely on the cross shaft "J." Brake friction is applied on the lever by a spring-loaded retainer acting on two friction discs with a stationary disc in between. The lever "L" has two arms, one connecting to the governor control rod "W" and the other to the speed control lever. The shape of lever "L" is such that it will contact lever "D," which is connected to the compression release lever, if the throttle is opened when the engine is operating on gasoline. This is a reminder to trip to the Diesel cycle before opening the throttle.

ADJUSTING STARTING CONTROLS

If the engine controls have been removed for any reason, the first thing to do is to assemble all controls, cross shafts, and their levers as shown in illust. 53A. Do not assemble the intake manifold or the valve cover, nor connect yoke "F" to lever "V." Levers "E" and "D" are the only ones rigidly attached to the cross shaft. The cross shaft should have .030 inch end play, and turn freely in bracket "T." Check end play by placing a feeler gauge between bracket "T" and lever "D."

A. Set controls for Diesel operation:

1. Adjust the screw "R" (insert, illust. 52A) until .060 inch clearance exists between jaw "B" and latch "A."

2. Adjust the yoke "F" (illust. 52A) on rod "G" so that when it is connected to lever "V" there will be .060 to .080 inch minimum clearance between the starting valve shaft cam "H" and valve cover "I." There should be no less clearance than .060 inch between the closest valve cover "I" and the cam "H," nor more than .080 inch between the cam farthest away from its mating valve cover. If it is impossible to adjust the valve clearances on all four valves within the limits of .060 to .080 inch, check the cams for wear and the shaft for twist. This assumes all the valves are seating properly. After completing adjustments, lock the nut on the clevis "F."

3. Rotate the cross shaft with the compression release lever until the lever "E" (illust. 53A) contacts the pick-up face on the jaw "B" at the point "X." Now adjust set screw "C" on the bracket "T" to give .100 inch between the set screw "C" and the lever "D" at point "Z."

B. Set controls for gasoline starting:

1. Adjust the set screw "U" (illust. 52A) in the jaw "B" to .015 inch between the set screw "U" and the bracket "S" at the point "UU."

2. Assemble the manifold to the engine and connect the link "Y", (illust. 53A) to the carburetor lever. The manifold trip yoke is in the "up" position.

C. Start the engine and run as a Diesel:

1. Retard the governor control lever until the poppet in lever "L" locates in a hole in the stationary plate (illust. 53A). This corresponds to the low idle speed.

2. Adjust the nuts "N" on the rod "W" until the springs "P" and "Q" are of equal length, and the engine idles at the speed desired (425 r.p.m.).

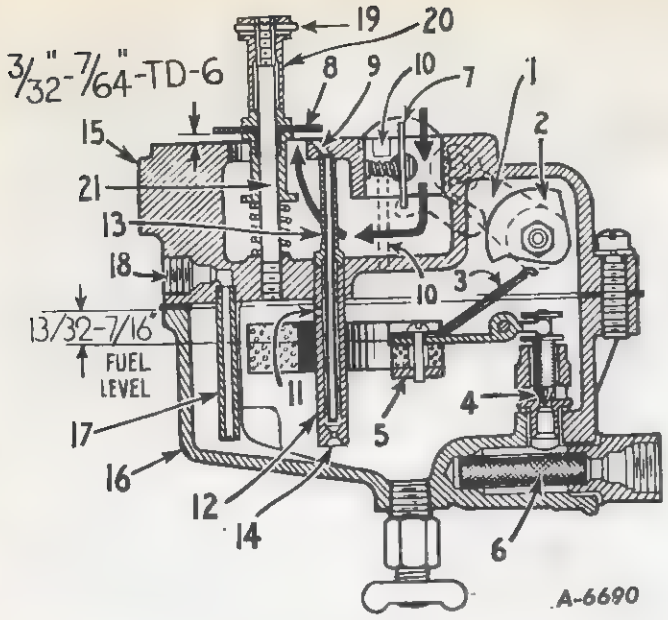
3. Move the speed control lever to the shutoff position; adjust the yoke on the speed control lever so the spring "P" is compressed but not compressed solid when the engine stops and the flat spot on the outside of the poppet on lever "L" contacts bracket "T" at "AA."

4. Operate the engine at full throttle. Adjust the speed control lever stop on the control housing (at the air cleaner) so the spring "Q" is compressed, but not compressed solid.

CARBURETOR (STARTING ONLY)

A dual manifold carburetor is used on this Diesel engine. As shown in illusts. 53A and 55A, the link "Y" is connected to the jaw "B" and to the carburetor locking lever (1). Pulling back the compression release lever turns the shaft "J" and the lever "E" which in turn rotates the jaw "B" which is free on the shaft "J."

As the link "Y" is raised with the jaw "B," the carburetor locking lever



Illust. 55A--Carburetor for starting Diesel engine.

(1, illust. 55A) is also raised. Raising this locking lever rotates the cam (2) inside the carburetor fuel bowl. In the Diesel position, the cam (2) contacts the spring (3), holding the needle valve (4) against its seat. The rotation of cam (2) takes it out of contact with the spring (3), allows the float (5) to drop, and lifts the needle valve (4) from its seat. Gasoline must pass through the filter screen (6) before entering the needle valve assembly. When the fuel level is 13/32 to 7/16 inch from the top of the float chamber, the float (5) will have raised far enough to hold the needle valve (4) on its seat and shut off the fuel supply. As fuel is used, the float maintains the level by opening and closing the needle valve.

With the manifold valves in the gasoline starting position, the air from the air cleaner is drawn past the choke valve (7), diagonally across the upper body (15), and around the air valve (8), which is open at all times. The vacuum around valve (8) draws the fuel mixture from the discharge nozzle (9). The mixture is carried through the small diameter passage to the intake ports.

The drilled passage (10), shown with dotted lines, equalizes the air pressure in the fuel bowl for the air bleed (11). The air bleed is located in the side of the metering well (12). As the engine picks up speed, the fuel level in the well is lowered. When it is lowered below the bottom of nozzle (13), air will be drawn from the air bleed and gasoline from jet (14), thus providing the proper mixture for constant idling speed.

When removing the carburetor, remove the link from the float locking lever and the dash choke control from the choke lever, the clip from the drip-hole tube, the gasoline supply line, and four nuts from the manifold studs. The carburetor body and fuel bowl assemblies may be separated by removing five fillister head screws. Use a good gasket; it normally extends 1/32 inch beyond the bowl and body.

The fuel bowl assembly consists of the float assembly and the fuel strainer. The strainer is easily removed. The spring (3, illust. 55A) on the float (5) is normally 1/4 to 5/16 inch above the surface of the bowl. The fuel level is normally 13/32 to 7/16 inch below the top of the bowl; the float is 9/32 inch with the float loose and the needle valve held firmly on its seat. The float can be removed by applying a screwdriver to the float pivot screw on the outside of the bowl. The pivot pin is pressed in the pivot screw and extends 1-7/32 inch from the head of the screw. The pivot pin should be straight to avoid binding the float. The spacer for piloting the other end of the pin is pressed in the fuel bowl.

With the float removed, the needle valve may be withdrawn for inspection. If worn, replace both the valve and the seat; they are furnished as service parts in pairs only. The needle valve cage hexagonal shape is 7/16 inch across the flats. The thickness of the gasket below the cage may be varied to change the fuel level. If the tang on the float is bent to change the level, remove the float from the pivot pin first to avoid bending the pivot pin.

As a solvent, use a solution of one part alcohol and one part benzine or a pure solution of acetone. Use either solution to dissolve all gums accumulating on the carburetor parts. Blow off the parts with clean dry air and reassemble them as indicated in the foregoing. Do not run wires through the needle valve cage.

The drip-hole filler 27445 DB is accessible after removing the drip tube and adapter. To prevent entrance of dirt, the packing should be replaced if it has disintegrated.

The supply tube (17) for the primer extends down into the fuel bowl and may

easily be unscrewed from the body (15) for cleaning. The slot in the end of the tube is .028 to .040 inch. The primer can be attached at the tapped hole adjacent to the drip tube.

The metering well (12) and nozzle (13) assembly is easily removed for cleaning by applying a thin screwdriver to the .045 to .059 inch slot in the bottom end. When replacing, after cleaning, be sure the upper end of nozzle (13) enters the hole in the top surface of the body (15). Use only a solvent and air to clean these parts. Opening (9) should be clean.

The air valve (8) should be set 3/32 to 7/64 inch. Remove the cotter key (19) at the top of the air valve collar (20) and rotate the collar to give the proper opening. A spring at the bottom of the air valve keeps the valve in the open position. Be sure the air valve is square with the bore and an equal distance from the top surface of the body all the way around. The valve may be pushed down against the body (15) to check the above. The guide (21) should be square with the top surface of the body. If the guide is replaced, the top end should be 1-1/4 inch above the surface of the body (15). On the bottom surface of the body, stake the guide to prevent its turning. The free length of the spring is 9/16 inch and tests 3 lbs. at 3/8 inch.

The choke valve (7) is equipped with a spring-loaded air valve to prevent excessive choking. The air valve should open freely. The choke can be removed by taking out two screws in the valve and drawing the shafts from each side. The body is not equipped with bushings for the shafts. The dust seals and retainers are located on each side and should be replaced if they are not in good condition. Soak the seals in oil before assembling. When replacing the valve, locate it in the slots in the ends of the shafts and center it in the opening in the body before drawing up the two screws. The countersunk side of the shafts faces the heads of the screws; upset the ends of the screws.

The float locking lever (1) connected to link "Y," etc., can be removed after taking the nut off the inside end of the shaft, slipping off the cam, and pulling out the shaft, spring, retainer, and two dust washers. If the bearing is worn, it can be replaced by unscrewing it from the body. It is furnished reamed to size as a service part.

When replacing the assembly, have lever (1), pointing toward the air valve (8); the flat sides of the shaft are then vertical. The cam is then assembled with the large rounded side toward the top of body. Replace the nut on the end of the shaft and draw it up tight.

Water or sediment can be drained through the valve in the bottom of the fuel bowl.

GOVERNOR FRICTION CONTROL

The engine is equipped with a governor friction control shown in illust. 53A. It is composed of the unit located under the cross shaft operating bracket "T." It prevents play in the control linkage from interfering with the speed regulation and also holds the governor control lever at the speed selected. The friction unit is all attached to the control lever "L," which turns freely on the cross shaft. Lever "L" has two arms, one connected to the governor control lever "K" and the other to the speed control. The shape of "L" is such that it will contact "D," which is connected to the compression release lever, if throttle is opened when engine is operating on gasoline. This is a reminder to trip lever to Diesel cycle before opening throttle.

Two independent friction discs sandwich a stationary disc that is anchored to the side of the engine crankcase. By removing the taper pin from lever "D," the cotter keys from lever "L," and the three cap screws from bracket "T," the entire assembly can be removed for adjustment to the tension desired to hold the throttle at the positions selected. With the unit off, reverse the friction assembly on the cross shaft to make the adjustment easy. Turn the tension nut clockwise to increase the spring tension on the discs. Two holes are drilled in the tension nut for tightening purposes. A flat tool with two pegs can be used. A pull of 10 ft.-lb. should be required to move the lever "L."

Replace the bracket and friction assembly on the shaft so the stationary disc engages the peg in the crankcase. Replace the cap screws and connect up the controls; the adjustment of controls

has not been changed. Be sure the cross shaft turns freely.

As shown in illust. 53A, the small pin in lever "L" drives the inner retainer. The tension nut is attached to "L" and the spring bears against the retainer and nut, holding the retainer toward the outside and squeezing the friction discs and stationary disc against the large diameter of lever "L." The normal position of the tension nut is 5/16 inch from the treaded end of lever "L."

INTAKE MANIFOLD

The dual manifold, referred to in the above text, carries the magneto grounding switch and the butterfly valves. The manifold may be removed after: 1-taking off the cover from the front end of the manifold and removing the wire for the magneto cutout switch; 2-shutting off the gasoline and disconnecting the supply tubing at the carburetor; 3-taking out the cotter key and disconnecting the choke control; 4-taking off the primer controls if the engine is so equipped; 5-taking off two nuts on the air intake flange; 6-taking out the pin and removing control link "Y" (illust. 53A) from carburetor; 7-removing four nuts from cylinder head.

When replacing the manifold be sure the gaskets are in good condition and be sure the holes in the gaskets line up with the holes in the manifold at both the cylinder head and the carburetor. Tighten the nuts holding the manifold to the head to 50 ft.-lb.

The butterfly valves can be removed after tripping the valves to the closed position and removing the two screws in each. Turn the shaft to the open position and withdraw the valves. Remove the nut and taper pin from the yoke on the valve shaft and pull the shafts from the manifold. The dust or air seals for the shafts are assembled with the lips facing each other.

When replacing the valves, remove any burrs from the slots in the shafts to avoid damaging the angular edges on the valves. Turn the shafts to the closed position, insert the screws, center the valves, and tighten the screws. Make sure the starting linkage operates freely; also that the manifold butterflies move freely from wide open to closed and that they close tightly when in starting position. Shakeproof lock washers with the round head screws are used; do not upset the threads.

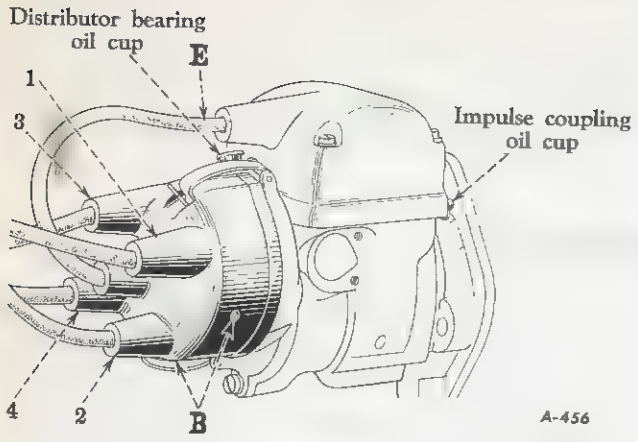
The yoke on the valve shaft locates with a taper pin and groove in the long rear shaft. The slot in the end of the shaft drives the forward shaft. The yoke is assembled with the flat side down. The valves should be adjusted to the horizontal position for Diesel operation to prevent any restriction of air flow. Loosen the lock nut and use the set screw (8, illust. 52A) on top of each end of the manifold to adjust the valves. Do not change the adjustment after the manifold is assembled to the engine. The over-center springs will hold the valves in each position. The set screw contacts the valve shafts inside the manifold end chambers.

The magneto grounding switch inside the chamber on the front end of the manifold is composed of two insulators and a terminal plate. The end of the valve shaft makes contact with a terminal plate in the Diesel position (7, illust. 52). Bend the prong of the terminal plate to make a good contact. Check the spark plugs while the engine is running on Diesel fuel to see if the switch grounds the magneto. There should be no spark. The switch opens when the compression release is lowered and makes contact when tripped.

MAGNETO

The magneto used on the "6" series Diesel engines for the starting cycle, is IH model H-4. It has a fixed spark, turns counterclockwise (facing drive end) and is flange mounted to the crankcase. An automatic impulse coupling insures hot sparks at cranking speeds. The coupling retards the spark timing 15° and is timed on the engine to trip 6-1/2° after top dead center of the piston travel. The magneto drive operates at the same speed as engine crankshaft.

The magneto grounding switch is located in the front end of the intake manifold and is operated by the manifold control shaft. When the compression release lever is placed in Diesel position, manifold control shaft closes magneto switch grounding magneto.



Illust. 58A--Counterclockwise rotation (viewed from the distributor end).

Greasing the breaker mechanism and checking the points on the counterclockwise rotation magneto is accomplished in the same manner as the clockwise rotation magneto used on the carbureted engines. See instructions on page 19.

The distributor cap should be kept reasonably free from dust and oil deposits and the rotor should also be kept clean. Two small ventilating holes "B" (illust. 58A) at the bottom of the distributor cap should be kept open at all times to help reduce the condensation of moisture within the cap.

Removal of the magneto from the engine is accomplished by disconnecting the switch wire from its terminal on the side of the magneto, disconnecting the spark plug cables and removing two cap screws and washers which hold the magneto to the drive bracket.

For complete servicing information on the H-4 magneto, refer to the Blue Ribbon Service Training Course, Manual No. 1, form CHS-27.

The magneto drive bracket with gasket is secured to the crankcase front plate by four 3/8 inch cap screws. The bracket, shaft, and gear assembly may be removed without removing the crankcase front cover, as the opening in the front plate is of sufficient size to allow the magneto drive gear to pass through. The bushing in the bracket is a steel backed babbitt replaceable type; it is reamed to size after being pressed into the housing. The shaft diameter is .9995 to 1.0005 inch. The running clearance of the shaft in the bushing should be .001 to .003 inch. The end clearance of the shaft with gear assembled is .003 to .013 inch.

When replacing the bushing, the 9/16 inch holes should be assembled to the front end of the bracket and arranged vertically to line with similar openings in the bracket; the small holes are then toward the magneto end. The end of the bushing should be flush with the front face of the bracket. The bushing must be reamed so that the bore is square with the mounting face of the bracket to maintain the alignment of the gear.

Timing the magneto drive gear when replacing the bracket is accomplished by marked teeth of the magneto gear and the camshaft gear. Two adjoining teeth of the camshaft gear are beveled on the rear edge and the meshing tooth of the magneto gear has a single punch mark on front side with rear edge beveled.

INSTALLING AND TIMING THE MAGNETO

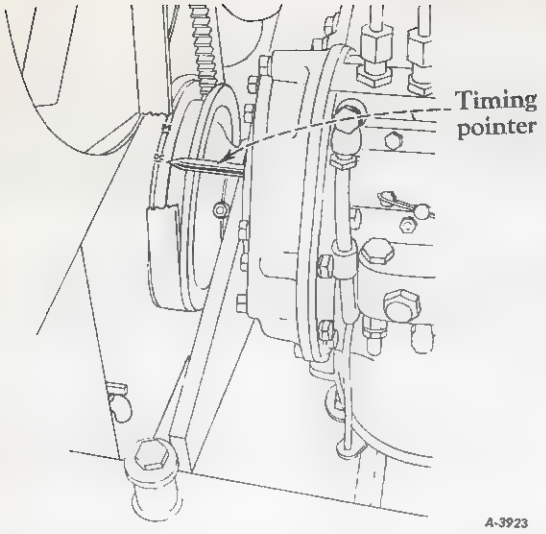
1. Pull out the cable "E" (illust. 58A) from the coil cover of the magneto to prevent the possibility of accidental starting.

2. Set the compression release lever in low compression position (gasoline operation).

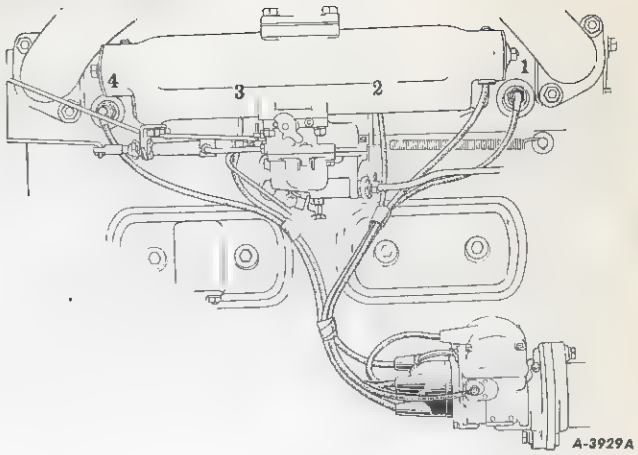
3. Crank the engine until the No. 1 piston (timing gear end of the engine) is on the top dead center of the compression stroke. The compression stroke can be determined by removing the No. 1 spark plug, placing your thumb over the opening, and cranking the engine until outward pressure is felt. Continue cranking slowly until the marked "M" on the fan drive pulley is in line with the timing pointer in the front crankcase cover (illust. 59A).

4. Remove the distributor cap and turn the magneto coupling in a clockwise direction (as viewed from the coupling end) until the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap.

5. Assemble the magneto on the engine. Make sure the lugs on the impulse coupling engage in the slots on the magneto drive coupling. Assemble the magneto so the top is as far away from the crankcase as the slotted mounting holes will allow.



Illust. 59A--"DC" dead center and "M" magneto markings on fan drive pulley.



Illust. 59B--Ignition wiring chart firing order of engine is 1, 3, 4, 2.

6. Insert the magneto mounting bolts with washers loosely in the flange, just enough to hold the magneto in place. Then crank the engine one complete revolution until the "M" mark on the fan drive pulley is in line with the pointer. Now slowly push the upper part of the magneto toward the engine, until the impulse coupling just trips.

7. Without moving the magneto from this point, tighten the mounting bolts securely. Attach the spark plug cables to the engine and magneto. Start by connecting the No. 1 cylinder spark plug to the socket marked "1" on the distributor cap; connect No. 3 plug with No. 3 socket; next No. 4; next No. 2 (see illusts. 59B and 58A).

8. To check the timing, crank the engine slowly until the impulse coupling just trips. At this point the pointer on the front crankcase cover should be between the mark "M" on the fan drive pulley and a point 9/16 inch beyond the mark "M." (Early production engines did not have the "M" mark on the fan drive pulley. On these the magneto impulse should trip 1/2 to 1 inch after the mark "DC" on the fan drive pulley rim.)

9. Push the cable "E" back into the socket in the coil cover.

It is important that the sound of the exhaust be sharp and snappy when first starting on the gasoline cycle. This is accomplished by the proper magneto timing as outlined above, and enables the engine to continue firing when cold and relatively stiff.

SPARK PLUGS AND CABLES

Spark plug gaps should be adjusted to .020 to .025 inch. Adjust by bending only the outer electrode. Sand blasting is the recommended method of cleaning spark plugs as it leaves the porcelain smooth and prevents a rapid accumulation of carbon.

Inspect the spark plug cables for the condition of the insulation and see that the cables have 1/4 inch minimum clearance from the heated portions of the engine; this protects the cable insulation from breakdown and shorting-out caused by the extreme heat of the engine parts.

The magneto end of the spark plug cables should be inserted in the sockets to their full depth to prevent sparking within the sockets. This will also prevent corrosion from forming at these points with its resulting high resistance to electric current.

COLD WEATHER STARTING

In cold weather the effect of low temperatures makes it necessary for the engine to be in good mechanical condition and any irregularity in the fuel and ignition system must be corrected to insure easy starting.

A systematic inspection will uncover these irregularities in the shortest possible time. Proceed in the following order:

1. Inspect the starting motor and battery for good condition and satisfactory state of charge.

2. Check the engine crankcase oil for proper viscosity, as recommended in the owner's manual for the prevailing air temperature. This insures proper lubrication and low cranking resistance.

3. Inspect the fuel system for condition and adjustment. See that fuel is delivered to the carburetor and that the carburetor float is in good condition and adjusted for the proper fuel level. Be sure carburetor metering openings are free from dirt or obstructions, that choke valve operates from fully closed to fully open position, and that carburetor outlet air valve is properly aligned and its opening adjusted.

4. Inspect the air cleaner for proper oil in the oil cup. Too heavy oil has a choking effect on the carburetor. Refer to owner's manual for correct viscosity for prevailing air temperature.

5. Inspect the manifold for possible air leaks at gaskets or at manifold butterfly valves when closed in the gasoline cycle position.

6. Check and correct the adjustments of the starting controls, following the instructions in another part of this section (see page 54).

7. Inspect the ignition system for condition and adjustment. See that the spark plugs are clean, dry, and the gaps properly spaced. Check the spark plug cables for the condition of the insulation and look for corrosion in the cable sockets of the distributor. Inspect the magneto breaker points and adjust. Flush the impulse coupling with the recommended lubricant as specified in the owner's manual. Test its operation. Remove the cable from the magneto coil cover and crank the engine slowly to determine the magneto impulse release point, compared to the timing point on the fan drive pulley.

FOLLOW THESE SAFETY RULES

The practice of safety in a service station is of utmost importance to the dealer, the individual serviceman, and to his fellow workers. The following safety cautions are suggested for your protection:

Never smoke in the service station where fire possibility is present.

Gasoline is dangerous as a cleansing agent because of fire; use non-inflammable solutions.

Wear goggles when performing welding, grinding, or chipping operations.

Rivet busting is dangerous; drill out rivet heads and then use a punch for removing the remaining portion.

Never work under heavy machines unless they are firmly supported.

Exercise every caution when engines are being operated in the service station; carbon monoxide is deadly.

Have a number of fire extinguishers located around the service station where they can be readily reached when needed.

Always give immediate and proper first aid to all injuries even though considered minor.

DIESEL FUEL SYSTEM

Specifications

Tractors--fuel tank ..... 20 to 21 gal.
Power units--remote supply tank
and belt driven supply pump.
Fuel filters ..... Replaceable element type
IH pump, auxiliary filter ..... Cotton, wound
IH pump, final filter.. Impregnated cellulose
Bosch pump, filter ....Combination cloth & metal

Fuel injection pump ..... Flange mounted
IH pump ..... Single plunger
Bosch pump ..... Four plungers

Injection nozzles ... IH, precombustion chamber
Nozzle opening pressure ... 700 lb. per sq. in.
Air cleaner ..... 7 in., oil washed wire filter
Air cleaner, in IH pump
breather line ..... Oiled felt elements

GOVERNOR DATA

IH Single Plunger Injection Pump Governor

Models	Full Load Governed Speed R.P.M.	High Idle Governed Speed R.P.M.	Low Idle Speed R.P.M.	Governor Spring Assembly	Torque Springs Required	Injection Pump cpl. with Springs
Farmalls MD and MDV, WD-6, ODS-6, TD-6	1450 ± 10	1610 ± 30	450 ± 25	67378 D	3-59781 D 2-65870 D	65306 D1
ID-6	1450 ± 10	1610 ± 30	450 ± 25	67378 D	3-59781 D 2-65870 D	65306 D2
IUD-6	1450 ± 10	1610 ± 30	450 ± 25	67378 D	3-59781 D 2-65870 D	65306 D3
UD-6	1500 ± 10	1665 ± 30	450 ± 25	67378 D	3-59781 D 2-65870 D	65306 D4

Bosch "A" Injection Pump — "GV" Governor

Models	Full Load Governed Speed R.P.M.	High Idle Governed Speed R.P.M.	Outer Spring	Inner Spring	Inner Spring & Seat Gap	Cam Plate	Injection Pump Complete with Springs
Farmalls MD and MDV, WD-6, ODS-6, IUD-6, TD-6	1450 ± 10	1575 ± 25	54518 D	55771 D	7.5 MM	56362 DX	52166 DB 14½
ID-6	1450 ± 10	1575 ± 25	54518 D	55771 D	7.5 MM	56362 DX	56028 DB 14¼
UD-6	1500 ± 10	1625 ± 25	54518 D	55771 D	7.0 MM	56362 DX	52166 DB 15

Bosch "K" Injection Pump — "GVA" Governor

Models	Full Load Governed Speed R.P.M.	High Idle Governed Speed R.P.M.	Outer Spring	Inner Spring	Inner Spring & Seat Gap	Cam Plate	Injection Pump Complete with Springs
Farmalls MD and MDV, WD-6, ODS-6, IUD-6, TD-6	1450 ± 10	1610 ± 30	62645 D	62651 D	4.5 MM	62268 DX	60021 D 14½
ID-6	1450 ± 10	1610 ± 30	62645 D	62651 D	4.5 MM	62268 DX	60064 D 14½
UD-6	1500 ± 10	1665 ± 30	62645 D	62651 D	4.5 MM	62268 DX	60021 DX 15

DIESEL FUEL SPECIFICATIONS
Do Not Use Dirty Fuel

Gravity (A.P.I.) . . . . . 30° minimum
Viscosity (Saybolt Universal at 100° F.) . . . . . 30.5 to 45 seconds

Distillation test (volatility) . . . . . 50% at 550° F. maximum; 90% at 650° F. maximum; End point 700° F. maximum
Cetane number. . . . . 43 minimum
Flash point. . . . . Minimum 130° F., or legal minimum
Pour point.. . . . . Must be 10° F., lower than minimum temperature at which the fuel oil is to be used
Conradson carbon (on 10% bottoms). 0.15%
Sulphur (by weight). . . . . 1.00% maximum
Sediment and water (by volume) . . . . . None
Corrosion. . . . . Pass
Ash. . . . . None
Color. . . . . 3 N.P.A. maximum

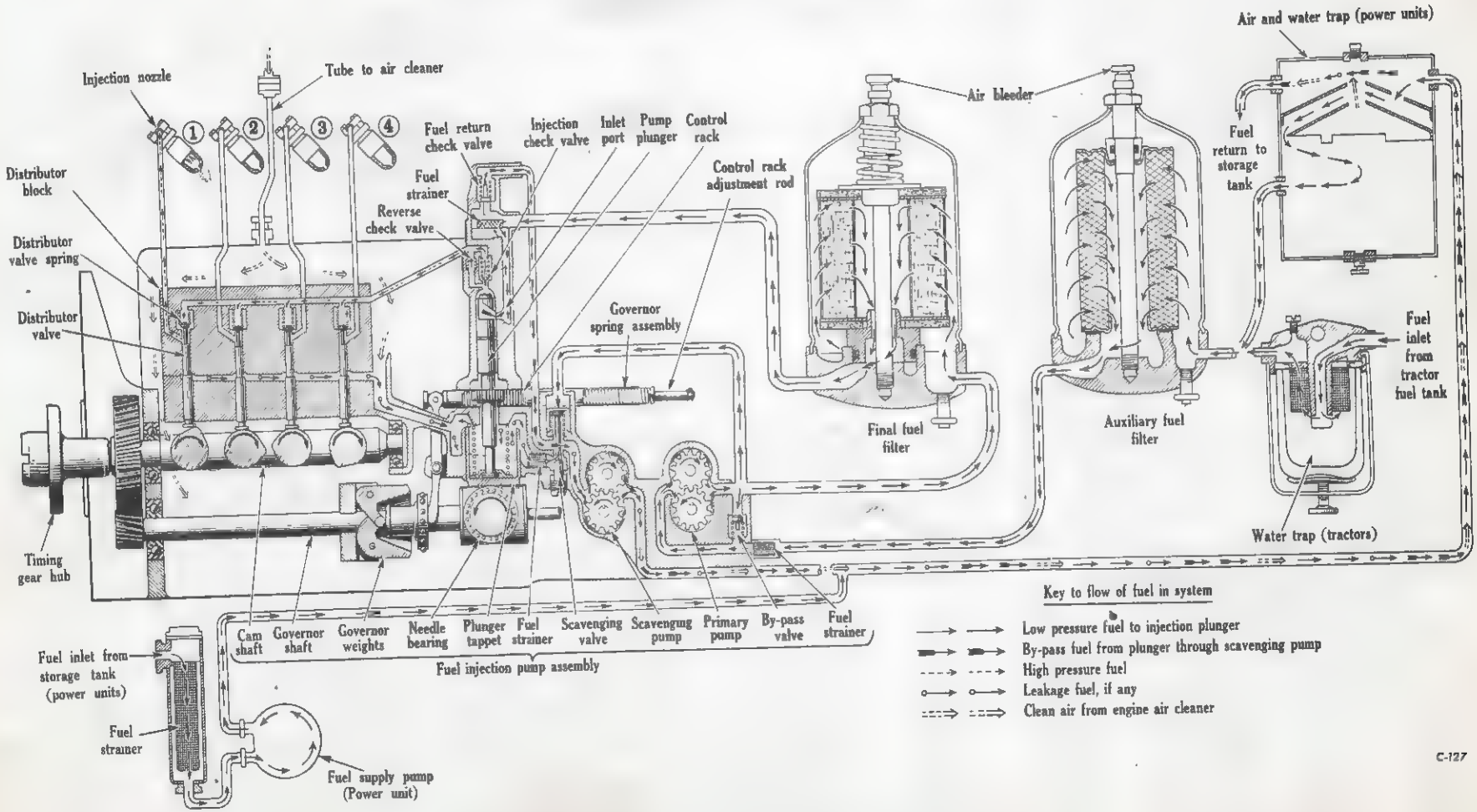
The supplier or distributor shall assume the responsibility of supplying a fuel oil of good ignition and burning qualities. Do not use a grade of fuel lower than specified above. The importance of using clean Diesel fuel cannot be overemphasized. Dirty fuel will cause rapid wear, and clogging of the fuel system.

NOTES ON SERVICING

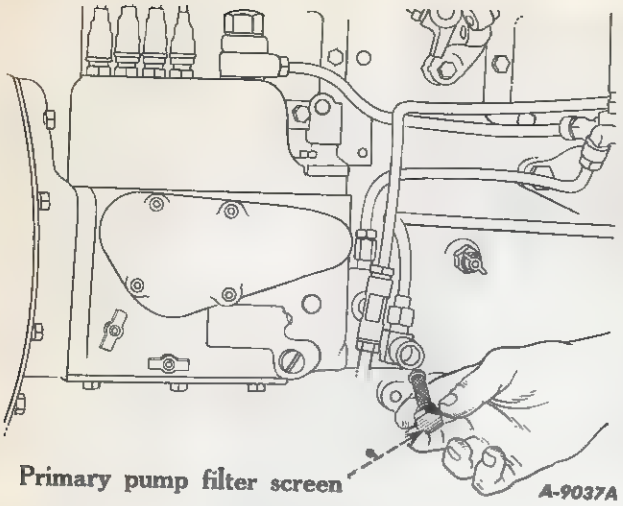
The Diesel fuel filtering system consists of the fuel strainer, the water trap, and the fuel filters. Where the Bosch injection pump is used the fuel filter consists of a cleanable combination metal and cloth element. Where the IH injection pump is used the fuel filters consist of an auxiliary replaceable element of the cotton wound type, and a final replaceable element of impregnated cellulose type. These improved design filters do an excellent job of removing abrasive material from the fuel.

The length of service secured from a fuel injection pump depends to a large extent on the cleanliness of the fuel. Dirt or water which is allowed to pass through the pump acts as an abrasive or has a corrosive effect on the highly finished and closely fitted moving parts, resulting in excessive wear or scoring of these parts. First consideration should be given to fuel that is supplied to the engine fuel tank. It should be as free from dirt and water as possible. The effective life of the fuel filters

SCHEMATIC DRAWING, FUEL INJECTION SYSTEM OF INTERNATIONAL FOUR-CYLINDER DIESEL ENGINES. FEATURING INTERNATIONAL SINGLE PLUNGER INJECTION PUMP



Illust. 63A--Schematic drawing of Diesel fuel system.



Illust. 64A--Removing primary pump filter screen.

depends on the amount of dirt and water that must be removed from the fuel.

The circulation of fuel in the system where the IH injection pump is used is shown in the schematic drawing 63A. Fuel, after leaving the tank, passes through the strainer and water trap to the auxiliary filter, through the auxiliary filter and the strainer at the intake of the primary pump (illust. 64A). Fuel leaves primary pump under pressure of 35 to 40 pounds per square inch, which forces it through final filter, intake strainer, and into injection pump inlet port.

Early production IH single plunger injection pumps were not equipped with strainer No. 67922 D for the intake of the primary pump. This strainer assembly should be installed on all pumps not so equipped.

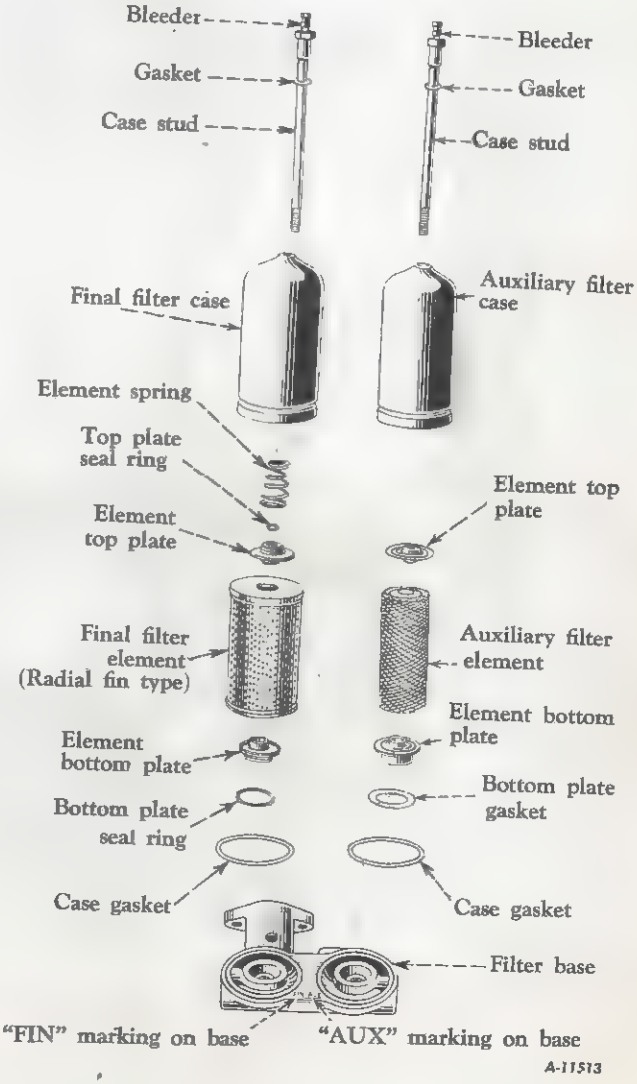
The effective life of the auxiliary filter element will be approximately 1000 hours under normal operating conditions. However, it must be understood that the life of this element will be greatly reduced if water is allowed to reach it, due to neglect to service the water trap. Another cause of early failure of the auxiliary element would be the use of fuels not within specifications, having a high gum or residue content.

The final fuel filter will give satisfactory service almost indefinitely if the auxiliary filter is properly serviced. Neither of these filter elements can be cleaned, therefore they must be replaced when they become clogged.

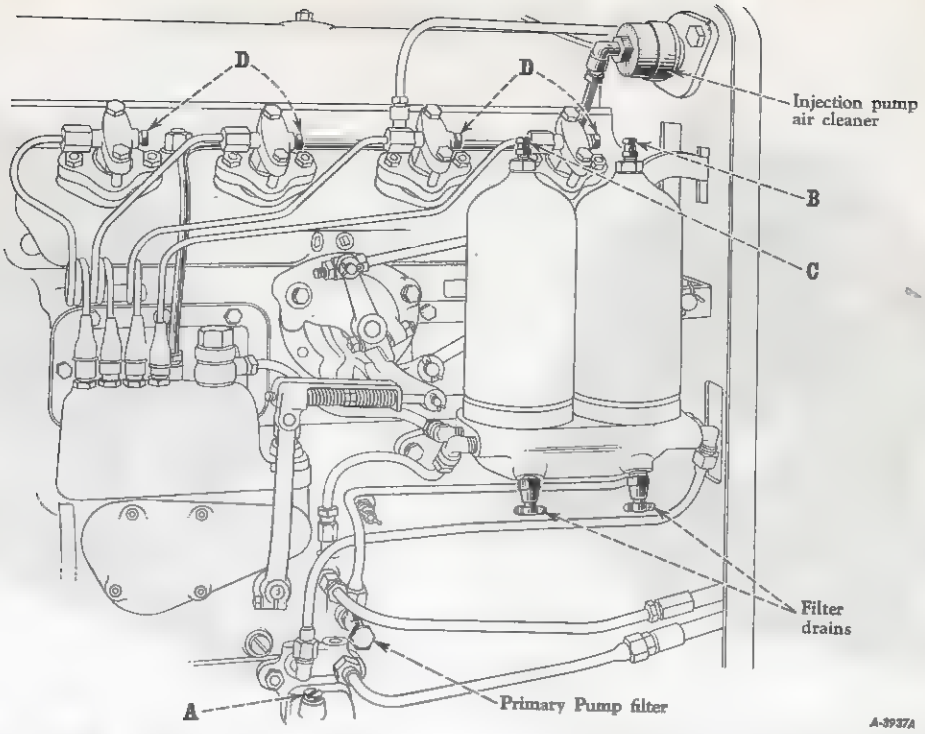
Venting Air from Fuel System

The engine will not run properly on Diesel cycle if there is air in the fuel injection system, due to "air lock." After changing the filter elements, or removing and replacing fuel lines or connections, air has entered the system and it is necessary to vent this air from the system. If the fuel in the tank is allowed to run low, or if the engine is operated a short time with fuel tank valve closed, the entire fuel system should be vented. Remove the air from the system by venting the water trap, fuel filters and injection nozzles on the engines equipped with IH injection pump as follows:

1. Before the engine is started and with the fuel tank valve open, open the water



Illust. 64B--Final and auxiliary fuel filter; sequence of assembly.



Illust. 65A--Air vents at fuel filter, water trap and injection nozzles, IH injection pump.

trap vent cock "A" (illust. 65A) and the auxiliary fuel filter vent cock "B." These vents should remain open until fuel flows free from air. The level of the fuel in the tank must be above the top of the auxiliary filter when the air is being vented.

2. Close the vent cocks when the fuel flows free from air.

3. Start the engine, then open the final filter vent cock "C."

4. Close the vent cock "C" when fuel starts to flow.

5. Advance the engine speed control lever slightly while operating on gasoline and open each nozzle vent "D" individually until the fuel flows free from air, then close the cock.

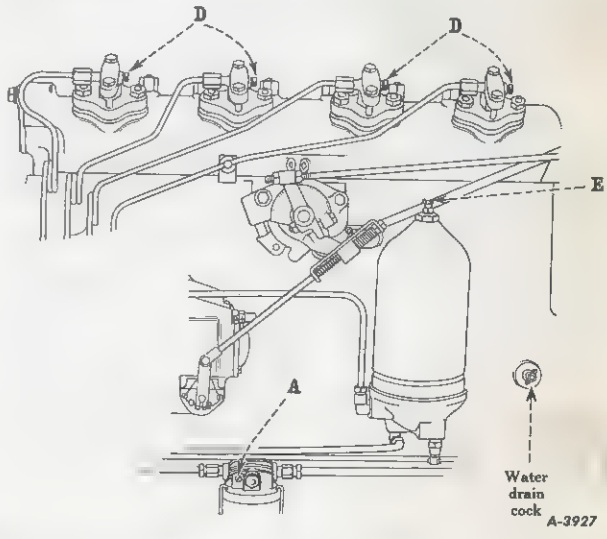
To vent the system where Bosch injection pumps are used proceed as follows:

1. Before the engine is started and with the fuel tank valve open, open the vent cock "A" (illust. 65B) on the water trap.

2. Close the vent cock when the fuel flows free from air.

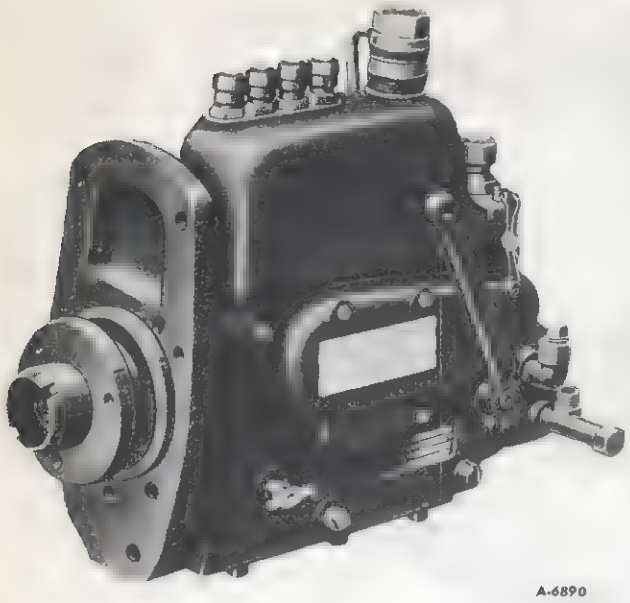
3. Start the engine and operate on gasoline; open the fuel filter vent "E"; close the vent when fuel starts to flow.

4. Advance the engine speed control lever slightly while operating on gasoline and open each nozzle vent "D" individually. Close each cock when the fuel starts to flow.

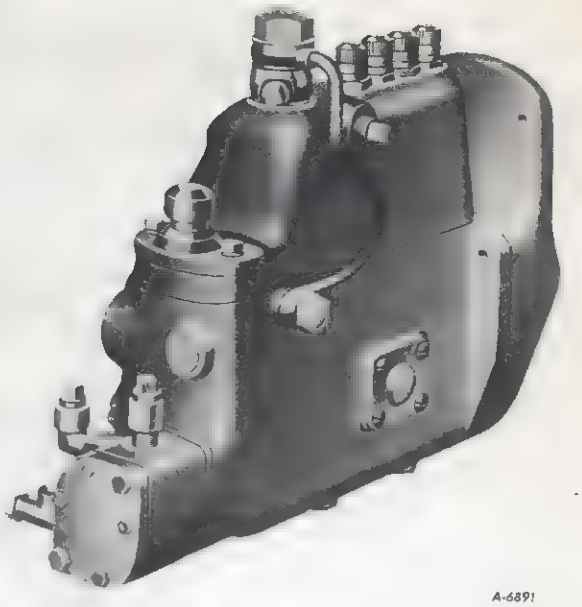


Illust. 65B--Air vents at fuel filter, water trap and injection pump nozzles, Bosch injection pump.

DIESEL FUEL INJECTION PUMP



Illust. 66A--Three-quarter front view of pump.



Illust. 66B--Three-quarter rear view of pump.

The IH Diesel single plunger injection pump (illust. 66A and 66B) is flange mounted to the crankcase front plate. The unit is completely inclosed in a grey iron alloy housing, all securely sealed against the entrance of dirt. Three metal fuel strainer elements are used to further protect the pump from dirt, one at the intake of the primary pump, one at the intake of the scavenging pump and the third strainer at the intake of the injection plunger unit. The primary pump strainer is accessible to the operator and should be cleaned when the auxiliary filter is changed.

This is a distributor type pump, using a single eccentric to actuate a lapped injection plunger at a constant stroke. The pump is equipped with a camshaft, turning at half engine crankshaft speed, which operates four distributor valves. The governor shaft is located below the camshaft and turns at twice engine crankshaft speed. The rear of the governor shaft carries the eccentric which operates the injection plunger. A coupling at the rear of the governor and eccentric shaft drives the scavenging and primary (gear type) pump unit.

After passing through the auxiliary fuel filter, the fuel is pumped by the primary pump through the final filter into the plunger unit and through a strainer into a reservoir surrounding the plunger bushing at the inlet port (illust. 63A).

As the injection plunger moves downward uncovering the inlet port, the fuel flows in, filling the space above the plunger. With the upstroke of the plunger, fuel at high pressure is forced through the injection check valve and passes into the distributor block, through a previously opened distributor valve, to a cylinder injection nozzle.

Injection of fuel ceases as soon as the lower helix on the plunger uncovers the port in the plunger bushing. This drops the fuel pressure above the plunger and permits the injection check valve to seat.

To prevent fuel dribbling from the nozzle after injection ends and causing exhaust smoke, a reverse check valve is built into the assembly above the plunger. This reverse check valve opens when injection ends and drops the line pressure existing in the system between the injection check valve and nozzle to a pressure below the opening pressure of the nozzle. The fuel thus released is returned to the space above the plunger.

The distributor valve opened by the camshaft determines which cylinder in the firing order (1-3-4-2) receives the fuel injected by the plunger unit. A distributor valve opens a short time before injection starts and remains open until shortly after injection is completed.

SERVICE CHARTS

FARMALL M'S, "6" SERIES TRACTORS, CRAWLERS and POWER UNITS

Chart 1. Carbureted Engine (End Section).

Chart 2. Wheel Tractor (Cross Section Through Right Side).

Chart 3. Farmall Tractor (Cross Section Through Right Side).

Chart 4. Crawler Tractor (Cross Section Through Right Side).

Chart 5. Diesel Engine (Side and End Cross Sections).

VALVE ADJUSTMENT: Clearance between rocker arm and valve stem is **.017"** with engine hot. Recheck after tightening rocker-arm assembly or cylinder head. Rocker-arm bushings can be replaced and reamed to size. Running clearance is **.002-.004"**; valve lever shaft is **.748-.749"** diameter Valve lever assembly does not have to be removed to tighten cylinder head nuts.

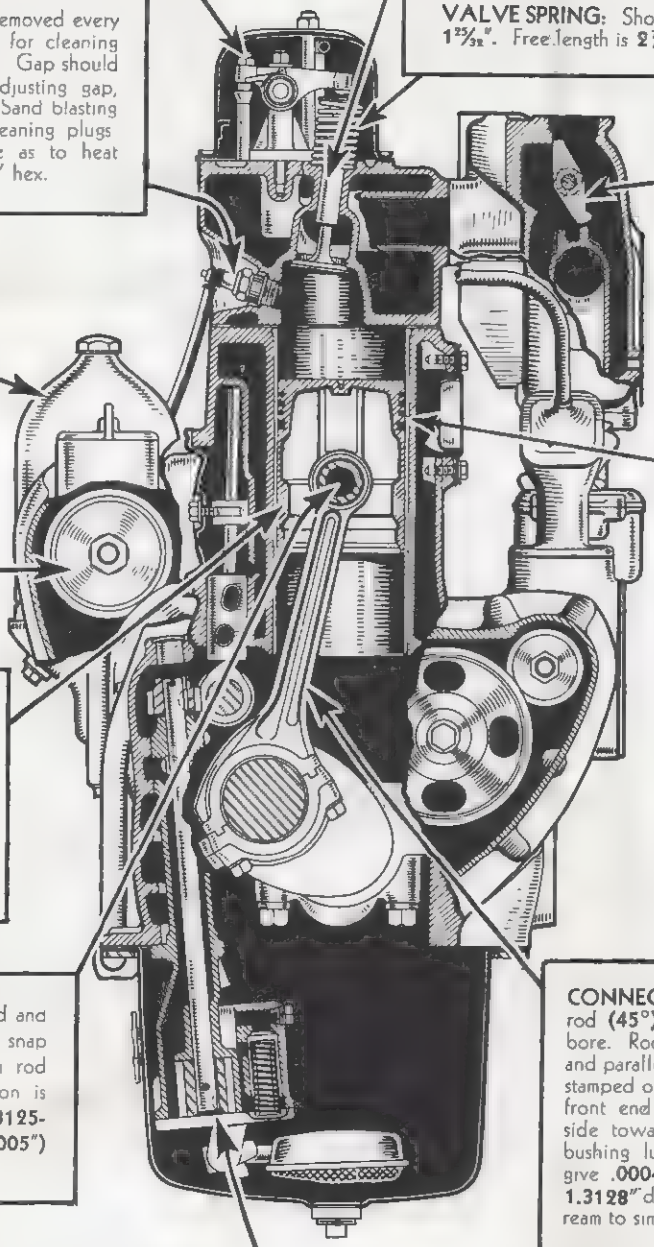
VALVE AND VALVE GUIDE: Clearance in guide is **.002** to **.004"**. Valve stem diameter is **.371** to **.372"**. Guide is assembled with chamfered end up. Repair guides are furnished reamed to size. Guide bore and valve seat should be concentric within **.002"**. Valve seat width is **3/32"**. Valve-seat inserts are standard in exhaust port. Grind replacement seat at **45°**.

SPARK PLUGS: Should be removed every **200** to **300** hours or oftener for cleaning and checking of electrode gap. Gap should be **.028** to **.032"**. When adjusting gap, bend only outside electrode. Sand blasting is recommended method of cleaning plugs Check plugs for correct type as to heat range. Size is **18 mm.** and **7/8"** hex.

VALVE SPRING: Should test **58** lbs. when compressed to **1 25/32"**. Free length is **2 7/8"**.

EXHAUST MANIFOLD-HEAT VALVE: Shown in closed position for distillate and kerosene engines. Gasoline engines do not have this type manifold

OIL FILTER: Element should be replaced every time oil is changed or oftener, if necessary



MAGNETO DRIVE GEAR

PISTON RINGS: Three compression rings and one oil control ring; oil ring is located above piston pin. Third compression ring from top of piston is tapered and should be assembled with the word "Top" toward top of piston. Fit rings to smallest section of sleeve bore in which ring travels. Ring gap **.010-.020"**. Clearance is groove; top compression **.004"**, all others **.003"**. Ring grooves should be clean and free of carbon and oil holes in oil control groove drilled out. Stagger ring gaps around piston; dip piston in oil before installing in sleeve

PISTON: Grey iron, select fit in sleeve to give **.004–.005"** normal measured clearance. A **1/2"** wide **.0035"** ribbon gauge is the **"GO"** at **4** to **6** lbs tension light pull, a **.0045"** ribbon gauge is the **"NO GO"** at **11** to **14** lbs tight pull.

PISTON PIN: Pin floats in rod and piston; it is held in by two snap spring retainers Clearance in rod bushing is **.0004"** and in piston is **.0002"**. Pin diameter is **1.3125-1.3128"**. Oversize pin **(+ .005")** is available

CONNECTING ROD: Split of connecting rod **(45°)** allows removal through cylinder bore. Rod should be straight, free from twist and parallel with piston; cylinder numbers are stamped on rod and cap, No 1 starting from front end of engine. Assemble numbered side toward camshaft side of engine. Pin bushing lubricated by splash is reamed to give **.0004"** clearance for pin of **1.3125-1.3128"** diameter. When using oversize pin, ream to similar clearance

CYLINDER SLEEVE: Dry liner type sleeves can be removed and replaced same as wet type sleeves, requiring no honing or boring after assembly. The standard replacement piston and sleeve sets are available for repairs. Puller **SE-1213** is available for removal of sleeves Coat outside of sleeve with light film of oil for ease of assembly. Wooden block held firmly across top of sleeve should be used when pulling sleeve into bore

OIL PUMP: Single gear type, draws oil through "Floato" oil screen and pumps oil to main, connecting-rod and camshaft bearings, timing gears and valve mechanism. Drive pinion is keyed and pinned to shaft and so is drive gear. Oil pressure regulating valve maintains **60** to **70** lbs. at **1450 R.P.M.** Located in pump body, spring should test **42** lbs. when compressed to **2 3/32"**. Free length of spring is **3 19/32"**. Pressure valve clearance in body is **.004-.006"**.

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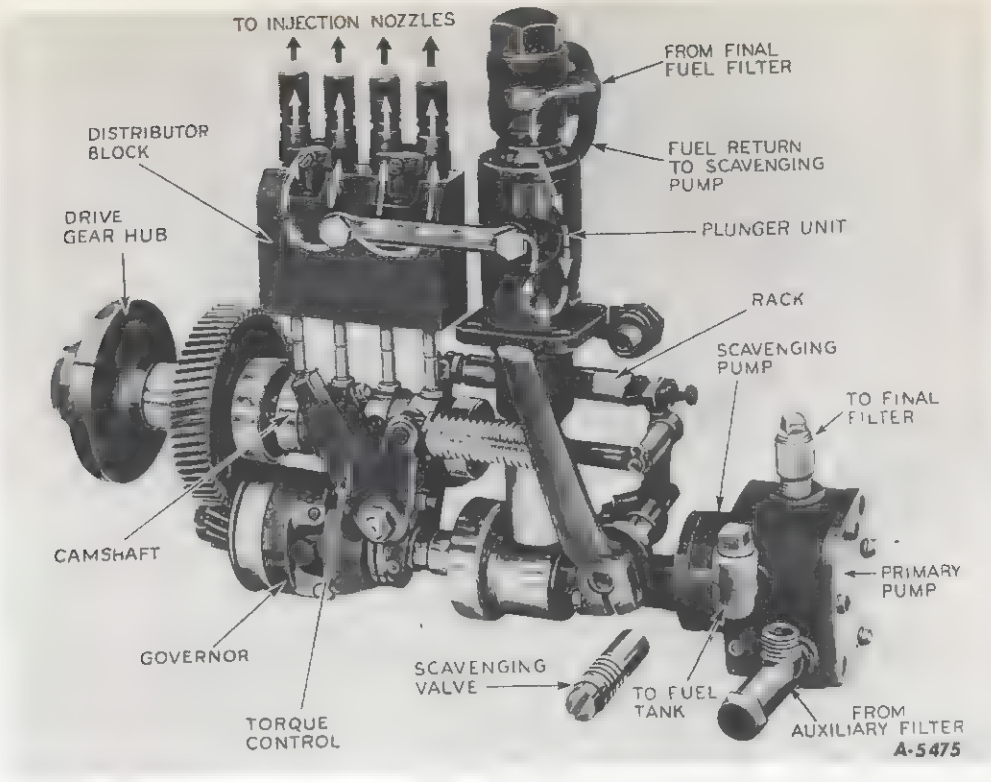
Chart 1. "6" Series Carbureted Engine



Illust. 67A--Skeleton view of pump mechanism.

The sensitive governor, acting on the helix type injection plunger, meters the fuel precisely the same for all four cylinders according to load demands.

A surplus of fuel is delivered to the plunger unit by the primary pump; this surplus fuel escapes through the fuel return check valve at the top of the plunger unit and is returned to the fuel tank by the scavenging pump. A small amount of fuel leakage past the distributor valve stems and injection plunger together with clean air from the pump vent is also returned to the fuel tank by the scavenging pump.

The scavenging valve placed at the inlet to the scavenging pump prevents fuel in the fuel return lines from backing up and diluting the oil in the pump sump when the engine is not operating. This valve is opened by pressure (from the primary pump) on the scavenging valve tappet when the engine starts.

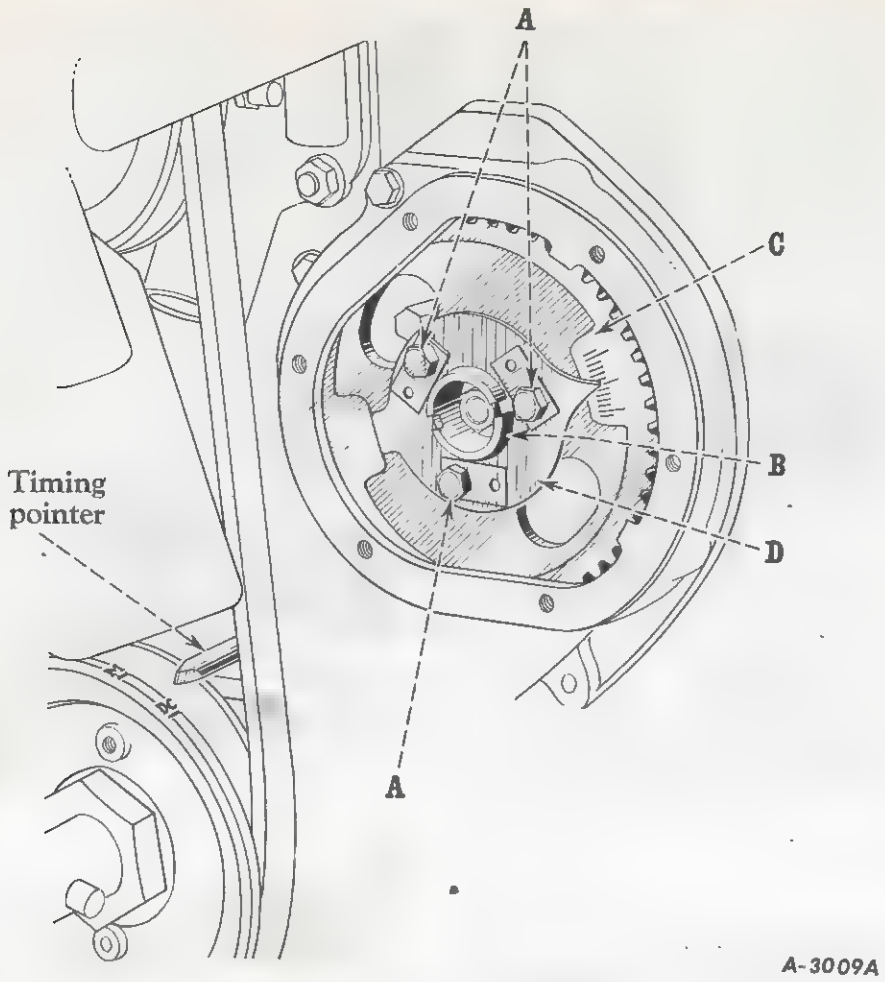
Fuel Injection Pump Removal

In case it becomes necessary to remove the complete fuel injection pump from the engine, the following instructions should be followed: Close the fuel shutoff valve at the tank. Place the compression release lever in the (gasoline) starting position. Disconnect the high tension cable from the magneto coil cover socket, to prevent accidental starting of engine.

Before removing any fuel lines from the pump, first clean the pump and connections thoroughly with fuel. When the lines are removed, the connections on the engine should be covered to prevent dirt from entering the system.

Disconnect the breather tube, the fuel lines to the injection pump, all injection lines to the nozzles, and the injection pump control rod. Remove the pump gear cover from the crankcase front cover, and remove the three 3/8 inch cap screws holding the hub, gear, and pointer together. Remove the complete injection pump assembly after taking out the five screws holding the pump to the crankcase front plate.

The pump drive gear on the "6" series Diesel engine cannot be removed through the opening in the front cover and cannot fall out of mesh with the idler gear; however, the engine must not be operated with the injection pump removed as the pump drive gear would be damaged.



Illust. 68A--Injection pump timing.

To replace the injection pump:

1. Disconnect the high tension cable from the magneto coil cover socket, if it has not been disconnected before.

2. Crank the engine until No. 1 cylinder is at top dead center of the compression stroke. This position can be determined by removing the No. 1 spark plug, placing your thumb over the opening and cranking the engine slowly until an outward pressure is felt. Continue cranking slowly until the notch marked "DC" on the front flange of the fan drive pulley is in line with timing pointer in the front crankcase cover (illust. 68A).

3. Check the pump gasket and cover gasket to be sure they are clean, and assemble in place.

4. Assemble the injection pump to the engine and secure by the center, inner and lower screws.

5. Turn the injection pump gear hub so that the groove on the hub and groove on the face of the injection pump gear line up. Place the timing pointer "B" on the hub with the pointer at 0° position. Bolt the hub, gear, and pointer together in this position with cap screws "A."

6. Replace the fuel pump gear cover. Reconnect the controls and fuel lines. Replace the magneto high tension cable and spark plug.

7. Vent all air from the fuel system as outlined on page 64, and reset the injection pump timing as required.

Fuel Injection Pump Timing

Injection pump timing may be advanced or retarded by shifting the position of the drive gear "C" (illust. 68A) in relation to the gear hub "B." The drive gear has slotted openings for the cap screws "A" to allow for a sufficient range of adjustment.

The adjustment is normally set with the indicator on the center mark of graduations on the pump gear. In order

to be sure of the best operating conditions, the indicator "D" can be tried on either side of the center mark and set at the best operating position.

The correct adjustment is obtained when the engine speed is maximum for a fixed load, and engine operation is smooth with a clean exhaust. This can be determined only after the engine is at proper operating temperature.

NOTE: For complete information on servicing injection pumps and governors, refer to the Diesel Fuel Injection Pump Service Manual.

DIESEL FUEL INJECTION NOZZLE

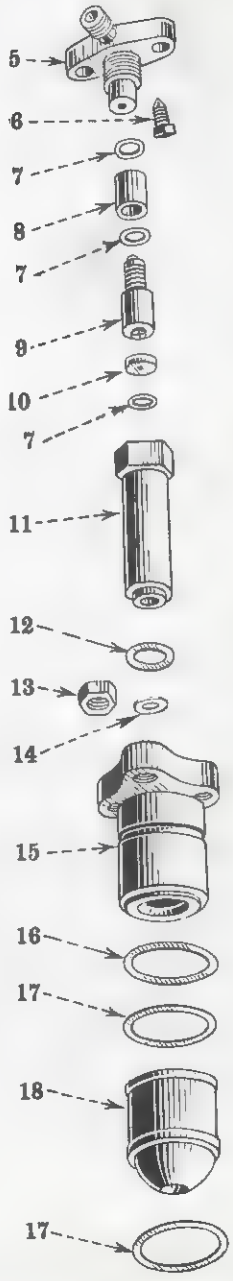
Specifications

Nozzle	IH, precombustion chamber
Nozzle valve	Spring loaded
Valve opening pressure	700 lb. per sq. in.
Nozzle injector plate orifice	.039 in.
Nozzle fitting to nozzle body, 7/8 inch thread, tension	90 ft.-lb.
Nozzle fitting to nozzle retainer, 3/8 inch cap screw, tension	20 ft.-lb.
Nozzle retainer stud, 3/8 inch nut, tension	20 ft.-lb.

The injection nozzle consists of a body (11, illust. 69A) which contains the nozzle injector plate (10), nozzle valve assembly (9), spacer (8), gaskets (7) and a nozzle fitting (5) which screws into the body (11) to hold the parts securely in place. The nozzle fitting is provided with a bleeder screw (6) to free the fuel line of air, and also to cut out the fuel injection to one particular cylinder for test purposes.

The nozzle body is a loose slip fit in the body retainer (15) and is sealed by dust seal (12) and gasket (14). The precombustion chamber (18) and body retainer (15) are a slip fit in the cylinder head and are sealed by dust seal (16) and gaskets (17). The injection nozzle assembly and nozzle body retainer (15) are held in assembly by two 3/8 inch cap screws, the body retainer (15) and precombustion chamber (18) are secured in the cylinder head by two 3/8 inch studs and nuts (13).

Fuel under high pressure passes from the injection pump outlet fitting, through the fuel pipe, and the nozzle fitting (5). As the pressure exceeds the opening pressure of the nozzle valve (9) the valve opens and fuel is injected into the precombustion chamber through the orifice in the plate (10).



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Illust. 69A--Exploded view of injection nozzle and precombustion chamber.

Injection Nozzle Removal

Before removal, clean the dirt from the nozzle assembly and cylinder head to

prevent entry of dirt when the nozzle is being removed. Disconnect the injection pipe and remove two retaining stud nuts. The precombustion chamber (18, illust. 69A) and gaskets (17) will remain in the head. These parts should be removed and cleaned. It is advisable to cover the cylinder head nozzle holes, after nozzles have been removed, to prevent the entrance of foreign material.

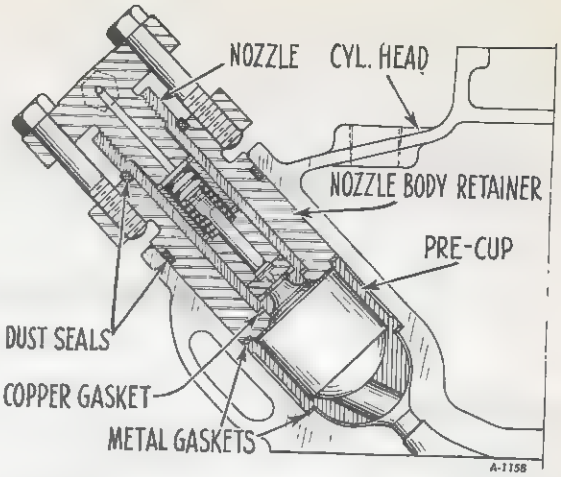
Disassembly of the nozzle can be accomplished by clamping two 3/8 inch rods, 1-31/32 inch apart, in a vise and placing the nozzle assembly upside down with the 3/8 inch rods engaging the cap screw holes in the nozzle fitting (5). This will hold the nozzle fitting while the nozzle body (11) is unscrewed. Removal will release three gaskets (7), the injector plate (10), the valve assembly (9), and the valve spacer (8).

Inspect the threads on the nozzle fitting (5) and bleeder valve (6) for damage; replace with new if damaged. All gaskets must be smooth and flat; if not, replace with new.

It is not recommended that the nozzle valve assembly (9) be disassembled for the following reasons: (1) the parts are furnished only as complete assembly, with the spring set for the proper opening pressure, and the threads on the valve stem are staked; (2) the valve and guide are not interchangeable, and springs are not supplied as a repair item; (3) no attempt should be made to lap the seats together. A narrow seat is essential for good performance and lapping would increase the seat width. Actually the valve and seat angles are different to insure a narrow seat.

Thoroughly clean all parts and as each part is assembled in the nozzle body, dip in clean fuel oil. Assemble in the following sequence: First place a gasket (7) in the bottom of the body (11); next place the injector plate (10) with the recessed side up, then the valve assembly (9) with the valve head down; next a gasket (7), spacer (8), and the last gasket (7); screw the nozzle fitting (5) into place. Replace the bleeder valve (6) and test the nozzle with the hydraulic test pump SE 905A.

Under test, the leakage past the nozzle valve at 700 pounds per square inch should not exceed 5 drops per minute. If the valve opens below 700 pounds per square inch pressure, or if the leakage is found to be excessive, the valve assembly (9) should be replaced.



Illust. 70A--Cross section of assembled injection nozzle and portion of cylinder head.

Install the nozzle assembly in the body retainer (15) by first placing the gasket (14) in the bottom of the retainer. Slip the dust seal (12) over the nozzle body (11). Insert the nozzle assembly in the retainer and secure with cap screws, tightening evenly to 20 foot-pounds with a tension wrench. Place the gasket (17) in the cylinder head. Insert the precombustion chamber (18), which must be inserted with the side stamped "UP" toward the center of the engine. Place the second gasket (17) on top of this chamber, slip the dust seal (16) into its groove on the nozzle retainer (15) and insert the nozzle and retainer assembly into the cylinder head and secure with two nuts (13) on the retainer studs, tightening evenly to 20 foot-pounds.

Uneven operation or smoking exhaust on one or more cylinders is usually caused by a defective nozzle. However, a distributor valve sticking open, or a distributor valve spring failure, will also cause uneven operation.

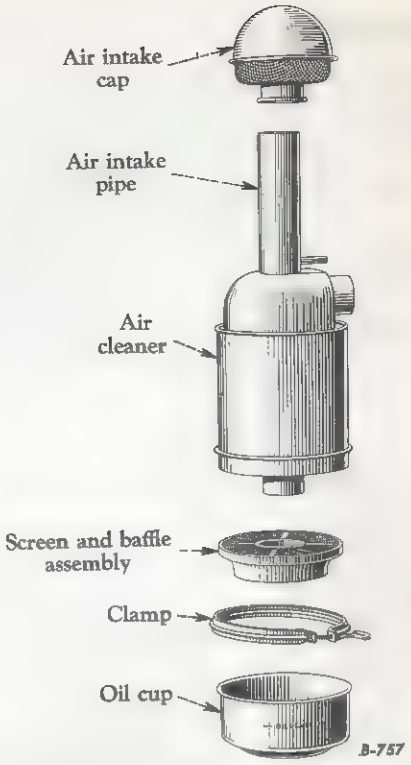
To determine which cylinders are involved, open and close the nozzle bleeder valves one at a time while the engine is operating on the Diesel cycle, until the affected cylinder is found. To determine whether difficulty is caused by defective distributor valve or spring, disconnect the injection pipes from the pump, start and operate the engine on gasoline cycle, and move the control lever until the pump starts to discharge fuel. An excessive amount of fuel discharged from any one fitting indicates failure within the distributor block, for the defective valve will pass fuel on each stroke of plunger in place of each fourth stroke.

AIR CLEANER

The air cleaner used on "6" series Diesel engines is the Donaldson oil washed screen type in the 7-inch size. A heavy screen in the air intake prevents large particles of trash from entering the air cleaner. The air then passes down to the oil cup where it goes through a bath of oil. As the air passes through the screens above the oil cup, some oil is carried up with it. Fine dust in the air is removed on contact with the oiled screen maze. As the oil works back down from the screens, the dirt is carried back with it and the dirt settles in the oil cup.

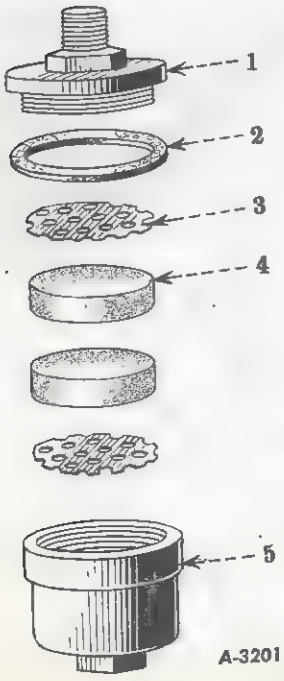
To insure efficient operation, the dirty oil in the air cleaner cup must be cleaned out and replaced with fresh oil each 10 hours of operation and more frequently when operating in dusty conditions.

Thorough cleaning of the screens and all air passages of the air cleaner each 60 hours of operation is important in addition to servicing the oil cup. Engine overhaul or tune-up jobs should always include a thorough cleaning of the air cleaner and inspection of all connections for possible leakage of dirty air into the engine.



Illust. 71A--Air cleaner taken apart for cleaning.

INJECTION PUMP AIR CLEANER



Illust. 71B--Injection Pump Air Cleaner

1. Body cap
2. Body gasket
3. Element retainers
4. Filter elements
5. Body

A small air cleaner is also found in the injection pump breather line. This consists of a cast iron body and cap inclosing two screens and oiled felt filter elements. The intake of this cleaner is connected into the intake of the main air cleaner. This cleaner is necessary because of a rather large volume of air pumped by the scavenging pump at times when a small amount of fuel is returned from the plunger unit. The felt filter elements may be cleaned, re-oiled with SAE-30 oil, and replaced as long as they completely fill the cleaner body; if shrunken or too badly gummed, the elements should be replaced with new.

COOLING SYSTEM

Specifications

Radiator:
U-6, UD-6, IU-6, IUD-6, T-6, and TD-6 ..... 3 row, flat tube, nonpressure type
All other models .. 2 row, flat tube, pressure type

Circulation ..... Centrifugal pump

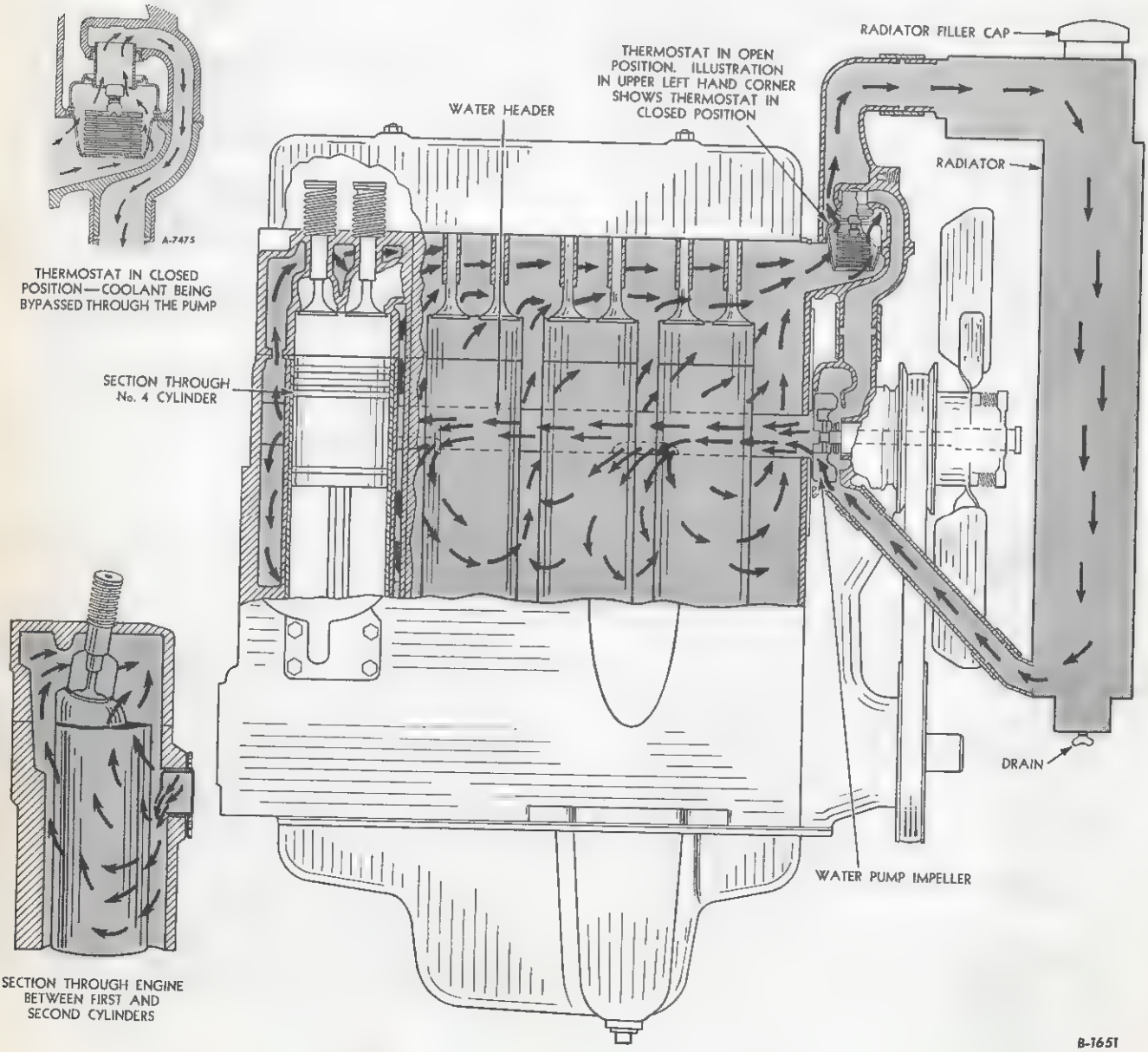
Pump capacity ..... 54 gal. per min.

Fan:
Diameter ..... 19 in.
Drive ..... V-belt
Ratio (fan to engine rpm) .. 1.42 to 1

Thermostat (by-pass type):
Starts to open ..... 165° F.
Wide open ..... 190° F.

Radiator shutter ..... Furnished with distillate and kerosene engines; available for other engines if desired.

Cooling system capacity ... See general specifications pages 2 and 3.



Illust. 72A--Schematic diagram of cooling system.

RADIATOR

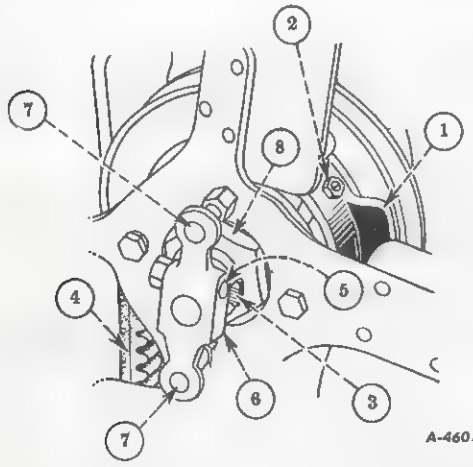
Radiators used on the crawler tractors, power units and tractor-engine-over-axle units of the "6" series are the conventional nonpressure type with three rows of flat finned tubes and an unrestricted overflow pipe. Radiators used on all other models of this series are the pressure type with two rows of flat finned tubes. The pressure type radiator was first used in regular production on the Farmall-M, serial number 60245, and on other wheel tractors of "6" series, number 5264. A pressure tight filler cap is provided with a pressure relief valve set to a predetermined maximum pressure, and a vacuum relief valve to prevent collapse of the radiator tanks during cooling in idle periods. The pressure radiator filler cap and the filler cap gasket must be in good condition and the cap tightened down fully. A loss of pressure from any part of the system during operation results in boiling and loss of water.

THERMOSTAT

A by-pass type thermostat is used to aid in warming the engine and controlling engine temperature. The thermostat is located in a housing attached to the front of the cylinder head. When the engine is cold the thermostat is closed and the water circulation is from the pump, through the engine block, up to the cylinder head and into the thermostat assembly from which it is by-passed to the pump. This forced circulation prevents formation of steam pockets during the warm-up period.

The thermostat starts to open at 165° F. The extent to which the thermostat opens controls the amount of water recirculated through the engine and the amount of cool water added from the radiator. With the thermostat in the wide open position (190° F.), the by-pass is closed and the flow is from the cylinder head, through the radiator, to the pump, through the engine block, and up to the cylinder head.

WATER PUMP



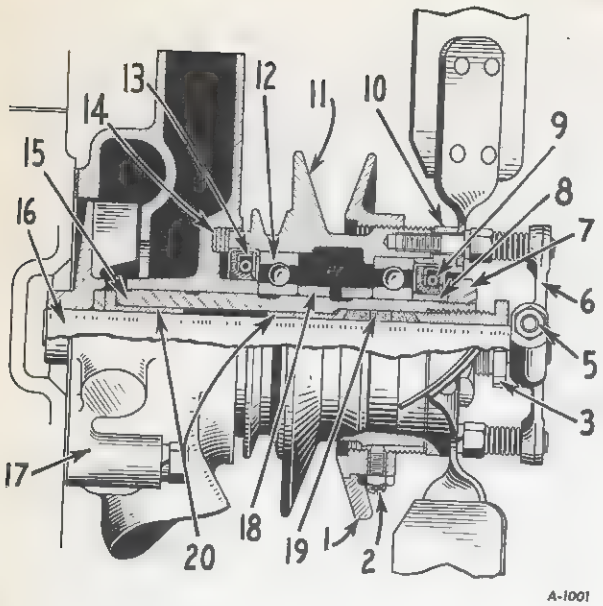
Illust. 73A--Water pump and fan assembly showing (1) fan pulley flange; (2) set screw in pulley flange; (3) water pump packing nut; (4) fan belt; (5) driver pin; (6) driver; (7) stud and (8) fan hub nut.

The water pump, a centrifugal type, is driven by two studs on the front face of the fan hub (illust. 73A). This pump circulates cooling water in a closed system through the engine block, cylinder head, thermostat, and radiator. Water is directed through the engine block by channels on the water header plates attached to the left side of the block. When replacing the header plates, be sure the flared end of the channel faces toward the front or water pump end of the block. Openings in the center of the channels face down.

The fan assembly and drive pulley run on ball bearings mounted on the sleeve, which is a press fit in the water pump body (illust. 74A). The impeller is driven by a full-floating shaft which does not carry any of the fan hub load or thrust.

Leakage of water at the outer end of the pump shaft is corrected by tightening the packing nut (3, illust. 74A). Using water pump wrench 11858D tighten only sufficient to stop leakage. If all adjustment is taken up on the packing nut, add more packing or remove the old and install new packing (19). Packing is obtainable in split rings.

To remove the water pump proceed as follows: Remove the radiator grille and radiator. Then remove the driver pin (5, illust. 74A), driver (6) and packing nut (3). Next take out the four 7/16-inch cap screws which secure the pump and fan assembly to the engine. The impeller and shaft (16) then can be slid out and the old packing (19) removed. After inserting new packing rings, reassemble by reversing the foregoing procedure.



Illust. 74A--Cross section of water pump showing (1) adjusting flange; (2) set screw; (3) packing nut; (5) driver pin; (6) driver; (7) bearing retaining nut; (8) lock sleeve; (9) oil seal; (10) bearing retainer; (11) fan hub; (12) rear ball bearing; (13) rear oil seal; (14) felt washer; (15) sleeve; (16) shaft with impeller; (17) pump body; (18) bearing spacer; (19) pump packing and (20) shaft bushings.

Complete fan hub and pump unit service is accomplished by removing the fan and parts mentioned above. Next, remove the bearing retaining nut (7, illust. 74A), retainer (10), oil seal (9), and lock sleeve (8). Support the fixed flange (11) in a press and push on the forward end of the sleeve (15) and remove the body and sleeve assembly from the pulley hub. Bearings (12) and spacer (18) may be removed for inspection. Oil seals (9 and 13) and felt washer (14) are replaced if oil leakage is indicated. The lips of both front and rear seal face the fan.

The running clearance of the impeller shaft in the bushings (20, illust. 74A) is .0015 to .0025 inch. Bushings are furnished with inside dimensions finished to size. The sleeve is also furnished complete with bushings. The sleeve (15) is a press fit in body (17). When replacing the sleeve in the body, the 1/8 inch drilled oil hole in the sleeve should line up with a similar drilled hole in the pump body bore. The hardened impeller shaft (16) is .6215 to .6220 inch diameter.

After assembling the sleeve to body, proceed as follows:

1. Place the felt washer (14, illust. 74A) in the body groove and lubricate it with oil.

2. Assemble the rear bearing (12) in the hub (11) with the adjustable flange (1) already assembled.

3. Place the rear oil seal (13) into the hub with the seal lip toward the bearing (12). The outside edge is flush with the end of the hub.

4. Press the hub assembly onto the sleeve and body assembly. During this operation support the latter under the sleeve. The bearing must fit tightly against the pump body. Several spacers (18) welded together make a good press tool for bearing assembly.

5. Assemble the outer bearing to the hub (11) and sleeve (15) with spacer (18) in place. The bearing inner race should be tight against the spacer (18).

6. Install the oil seal (9) in the bearing retainer (10) with lip of seal facing fan when set in place.

7. Place the lock sleeve (8) on the sleeve (15). The bearing retaining nut (7) can now be placed and tightened.

8. Place the impeller (16) in the assembly, add packing (19), packing nut (3), fan, and pump driver assembly.

9. Grease the bearings with chassis lubricant before assembling to the hub. Impeller, thrust washer (hardened), and shaft are obtainable only as a complete assembly.

ENGINE CLUTCH

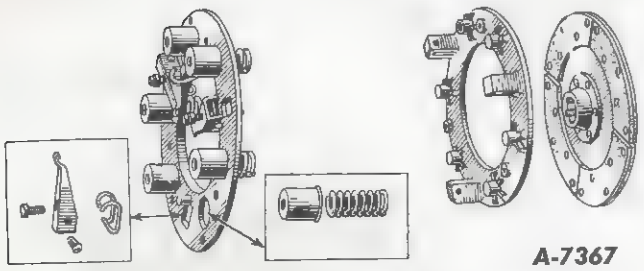
SPECIFICATIONS

Used On	Clutch No.	Type	Size
Farmalls M, MV, MD and MDV, W-6, WD-6, I-6, ID-6	48965 D	Spring-loaded, foot operated.	11 in.
O-6, OS-6, ODS-6	54874 DB	Over-center, hand operated.	11 in.
T-6, TD-6	51397 DD	Over-center, hand operated.	12 in.
IU-6, IUD-6	14737 DA	Spring-loaded, foot operated.	11 in.
U-6, UD-6	37092 DB	Over-center, hand operated.	11 in.

DESCRIPTION

Two general types of engine clutches are used in the "6" series tractors and power units. The first is a foot operated, spring-loaded clutch. This type is normally in the engaged position, being disengaged only for short intervals while shifting the transmission or power take-off gears. The second type, a hand operated over-center clutch, is used where foot operation is impractical and where normal operation requires the clutch to remain disengaged without attendance of the operator. Two sizes of over-center clutches are used; the larger is used in the crawler tractors where many jobs, such as bulldozing and shovel operations, require frequent use of the engine clutch.

ADJUSTMENT



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Illust. 75A--Engine clutch parts, spring-loaded type.

Farmalls M, MV, MD and MDV. On these models the clutch pedal should have 1-1/8 inch free movement from the stop on the transmission cover when the clutch is fully engaged. As the clutch wears, free movement decreases. Adjustment is made before free movement has become less than 7/8 inch. The clutch may be badly damaged if free movement of the foot pedal is not maintained. Adjustment is made by changing the length of the rod connecting the foot pedal to the release shaft.

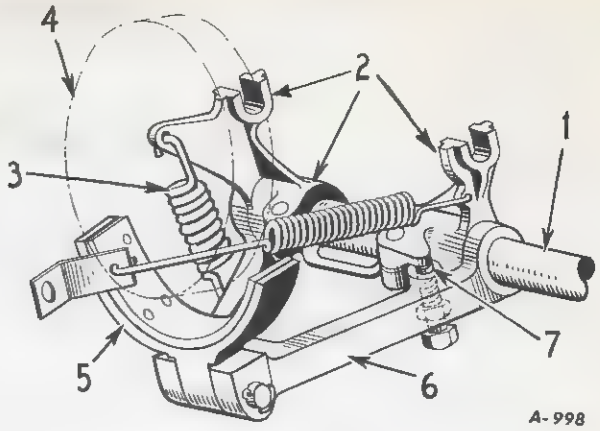
Inspection of the clutch release bearing and levers is made by removing the cover from the lower side of the clutch housing. The complete clutch assembly may also be removed through this opening. Complete instructions for the removal and rebuilding of all clutches will be found in Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

Illust. 76A--Clutch pedal "FREE-MOVEMENT" adjustment.

Tractors W-6, WD-6, I-6 and ID-6. The clutch pedal on these models should have 1-1/8 inch of free movement from the stop on the transmission cover to the point "A" (illust. 76A) on the pedal when the clutch is fully engaged. Readjustment is made when movement has been reduced to 7/8 inch. Adjust the free movement by changing the length of the rod "B." The adjustment of clutch brake (found on the I-6 and ID-6 only) should be made at the same time.

The clutch brake automatically stops the clutch shaft when the clutch is disengaged which makes the gears shift more readily. After correcting the clutch pedal free movement, and with the pedal back against its stop, adjust set-screw (7, illust. 76B) on the clutch brake so that 1/2 inch of clearance is maintained between the brake lining and the lowest point on the forward side of the brake drum. In this way the clutch brake is not applied until after the clutch is released by the movement of the clutch pedal and the release fork.

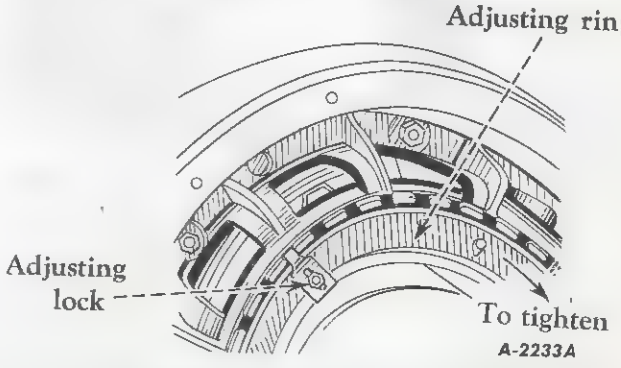
Inspection of the clutch release bearing and levers, and adjustment of the clutch brake are made by removing the cover from the bottom of the front frame. Removal of the clutch assembly is made by removing the clutch compartment top cover. Complete instructions for the removal and rebuilding of all clutches are found in Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.



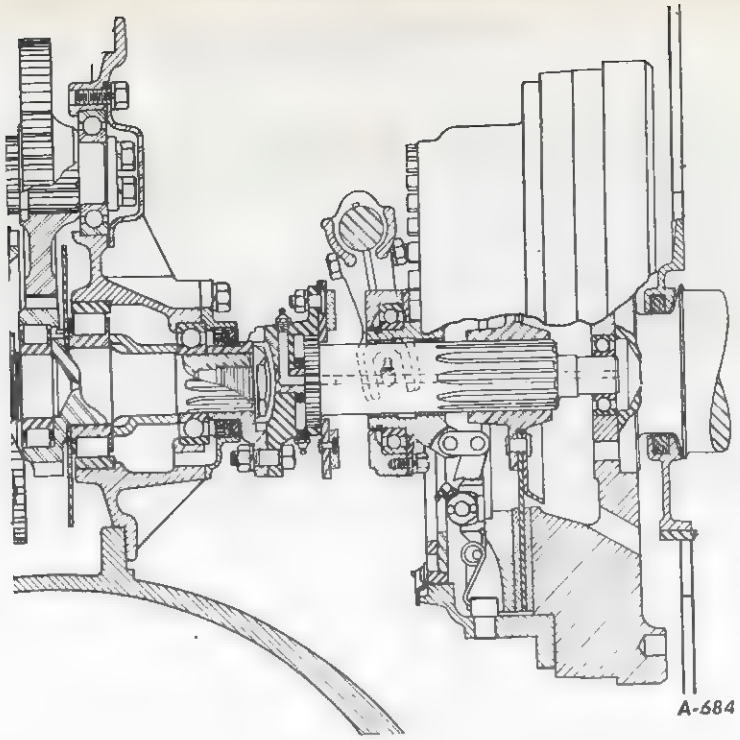
Illust. 76B--The I-6 clutch brake, showing (1) clutch release shaft; (2) clutch release fork; (3) clutch brake spring; (4) Transmission drive flange; (5) brake shoe; (6) brake yoke and (7) set screws.

Tractors O-6, OS-6 and ODS-6. The clutches on these models are engaged by pushing the clutch hand lever forward. Full engagement is accomplished when a definite over-center cam action is felt. Rapid wear of the clutch facings will result if slippage occurs while the engine is under heavy load.

As the clutch wears, less effort is required to push the clutch hand lever into full engagement. It is then necessary to readjust the clutch, to prevent slippage. Adjustment is made by removing the clutch compartment cover on the bottom of the front frame. Loosen the nut on the adjusting lock (illust. 76C) and disengage the lock from the notch in the back plate. With the clutch hand lever in the disengaged position, turn the adjusting ring clockwise one or two notches. Check the engagement by pushing the hand lever. Continue adjustment and checking until the correct engagement is obtained. Replace the adjusting lock and secure it with the nut. Do not have the clutch adjusted so tightly that full over-center engagement is difficult to obtain with the hand lever.



Illust. 76C--Adjustment of over-center clutch.



Illust. 77A--Over-center clutch cross section, crawler tractor.

Remove the clutch assembly by removing the clutch compartment top cover. Complete instructions for removal and rebuilding clutches are found in Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

Crawler Tractors T-6 and TD-6. The over-center clutch is engaged by pulling back on the clutch hand lever until the over-center cam engagement is felt. Adjustment is made as outlined for the 0-6 model above by removing the clutch inspection cover on the floor plate ahead of the steering levers.

Remove the clutch assembly by removing the floor plate covering the clutch compartment. For complete removal and rebuilding instructions see Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

Tractor-Engine-Over-Axle Units IU-6 and IUD-6. These units, equipped with spring-loaded clutches, require free movement of the operating linkage to prevent the release bearing from making contact with the release levers when the clutch is engaged. The manner and location of the adjustment for this free movement differs with the various manufacturers who use these units in their completed machines. This important adjustment is checked by being sure that 3/16 inch clearance exists between the release bearing and the release levers when the clutch operating linkage is in the fully engaged position. Inspection of the release bearing and release lever clearance is made by removing the inspection plate on the clutch housing cover.

Remove the complete clutch assembly by removing the clutch housing from the flywheel housing. For complete information on removal and rebuilding refer to Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

Power Units U-6 and UD-6 are equipped in regular production with the hand operated over-center clutch. Forward movement of the hand lever engages the clutch. When a definite over-center cam engagement is felt the clutch is fully engaged.

Rapid wear of the clutch facings results if slippage takes place while the engine is under a heavy load. When a definite over-center cam engagement is no longer felt, or little effort is required to push the clutch lever forward, the clutch should be adjusted to prevent slippage. Adjustment is made through the upper or lower hand hole in the clutch housing. Adjustment is made as outlined for the 0-6 model above.

Remove the complete clutch assembly by removing the clutch housing from the flywheel housing. Complete information on removal and rebuilding clutches is found in Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

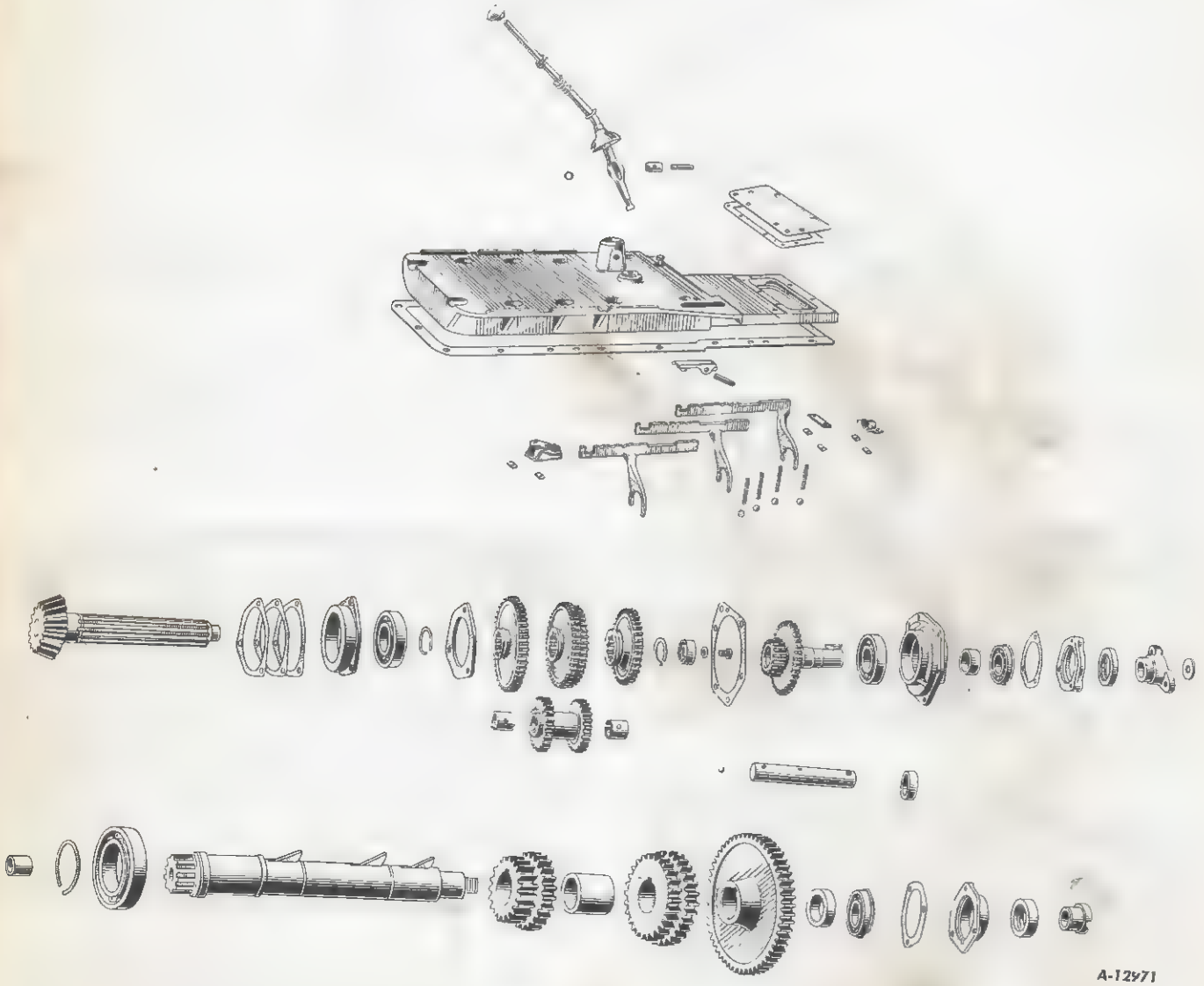
TRANSMISSION

The transmissions in the Farmall-M series and the "6" series tractors are of the selective spur gear type with five speeds forward and one reverse. As a safety measure to prevent high speed operation on wheel tractors equipped with steel wheels, the fifth speed is locked out. A set screw in the rear frame cover limits the movement of the transmission shifter rail which prevents shifting to fifth speed.

The transmission driving shaft and the upper and lower shafts are carried on ball or roller bearings which are mounted in cages in the main frame. This cage mounting of bearings prevents damage to the main frame should bearing failure occur from any cause.

Lubrication of the transmission is accomplished by the lower shaft gears running in oil, the upper shafts and gears being lubricated by splash and gravity flow of oil directed to bearings by channels and drilled passages in the housing.

Oil capacities and traveling speeds for the various units are found in the specifications on pages 2 and 3.



Illust. 78A--Exploded view of Farmall and Wheel Tractor Transmission.

FARMALLS M, MV, MD, MDV, TRACTORS W-6, WD-6, O-6, OS-6, ODS-6, I-6 AND ID-6.

Refer to Service Charts in center of this Manual and Illust. 78A

DISASSEMBLY

Disassemble the transmission on the above models as follows:

1. Remove the engine clutch unit. Complete instructions for this operation are found in Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

2. Drain the lubricant from the transmission compartment and clean the dirt from the transmission and rear frame cover. Remove belt pulley attachment if so equipped.

3. The transmission cover is secured with cap screws and held in alignment with dowel pins. Care must be used in removing to prevent distortion of the shifter forks which are attached to the under side of the cover. Remove the power take-off attachment if so equipped.

4. The transmission drive gear assembly is removed by removing the six 3/8 inch cap screws from the upper front bearing cage. Place the cap screws in the tapped holes of the cage to pull the complete assembly.

5. The pinion shaft with sliding gears is taken out by removing the three cap screws from the upper rear bearing cage. Move the shaft and the cage forward and lift out the complete assembly. Shims are found between the cage and housing. These shims are used to adjust the mesh of the pinion in the bevel gear. They are saved for replacement if no bevel pinion adjustment is necessary.

6. The lower or countershaft is removed by taking out the rear bearing snap ring which is accessible from the differential compartment. Drive the rear bearing off the shaft with a drift applied to the inner race. Remove the bearing retainer, nut and washer from the front end of the shaft in the clutch housing. Using a babbitt hammer drive the shaft to the rear out of the front bearing.

7. Lift the countershaft assembly from the housing by tilting the front of the shaft up first. Removal of brake cross shaft is not necessary.

8. The reverse idler shaft is now slid forward after taking the retaining bolt out of the bracket. The idler gear is carried on two bushings. These bushings are reamed after assembly to 1.237 to 1.238 inches. The bore of the bushings should be concentric with the pitch diameter of the gear. The two 1/4 inch holes in the shaft are lubricating oil passages and are assembled toward the rear of the frame.

9. The gears on the lower or countershaft are keyed and pressed onto the shaft, except first speed gear, on the O-6 models and I-6 models, or where the low low-speed attachment is used. Remove and replace the gears separately by use of an arbor press.

10. The rear bearing on the upper or pinion shaft is driven off through holes in the pinion after removal of the snap ring retainer. Roller bearing at front end of this shaft has a retainer and a bolt to hold it in position.

Cleaning Ball Bearings

Wash the ball bearings in clean solvent to remove old lubricant and traces of dirt. Use carbon tetrachloride if kerosene or regular cleaning solvents do not remove deposits of old lubricants. If an air gun is used, hold both the inner and outer race to prevent rotation. Direct the air squarely at the side or face of the bearing. Do not spin a bearing with the air gun; considerable damage by scratching or scoring may be done before the dirt is blown out. After the bearings are thoroughly cleaned, coat all surfaces with clean, light engine oil and inspect them for wear or damage. Do not use a damaged bearing. Wrap the bearings to be re-used in clean, dry paper for protection until ready for installation.

ASSEMBLY

Assemble the transmission as follows:

1. Place the lower or countershaft and gear assembly in the housing slip bearing on the rear end of the shaft and move the shaft to the rear.

2. Assemble the front bearing in the housing with the snap ring. Assemble the front bearing cap retainer. Drive the shaft to the front into the bearing. Remove the cap and place the nut and washer on the end of the shaft.

3. Drive the rear bearing to its shoulder and slip the snap ring into place. Be sure that the spacer between the front gear and the bearing is in place before driving the shaft into the front bearing.

4. The upper or pinion shaft assembly with sliding gears is assembled forward and then moved backward and secured with three cap screws in the upper rear bearing cage. If no change of bevel gears is necessary, and the original gear adjustment was satisfactory, replace the same shim pack which was found behind the upper shaft in the rear bearing cage. If gear adjustment is necessary, follow the instructions on page 83 under "DIFFERENTIAL AND DRIVE BEVEL GEARS."

5. The transmission shift lever, shifter rails, poppet balls and springs are mounted in the transmission housing cover. The shifter rails and poppet assemblies may be removed by spreading the four cap screw locks and removing the four 3/8 inch cap screws which secure the two guide brackets. Shift lever is removed by driving out shift swivel shafts after removing swivel shaft hole plug.

6. The shifter rail poppet notches should not be worn to allow the poppet balls excessive motion lengthwise of the rail. The poppet springs may be compared with new stock for over-all length and tension.

7. Care should be taken in removing and replacing the transmission cover so that the shifter forks are not bent or sprung out of alignment which will result in only partial meshing of the gears. Be sure that the shifter forks engage the grooves of their respective gears. Shift into all speeds as a check. Replace the lubricant.

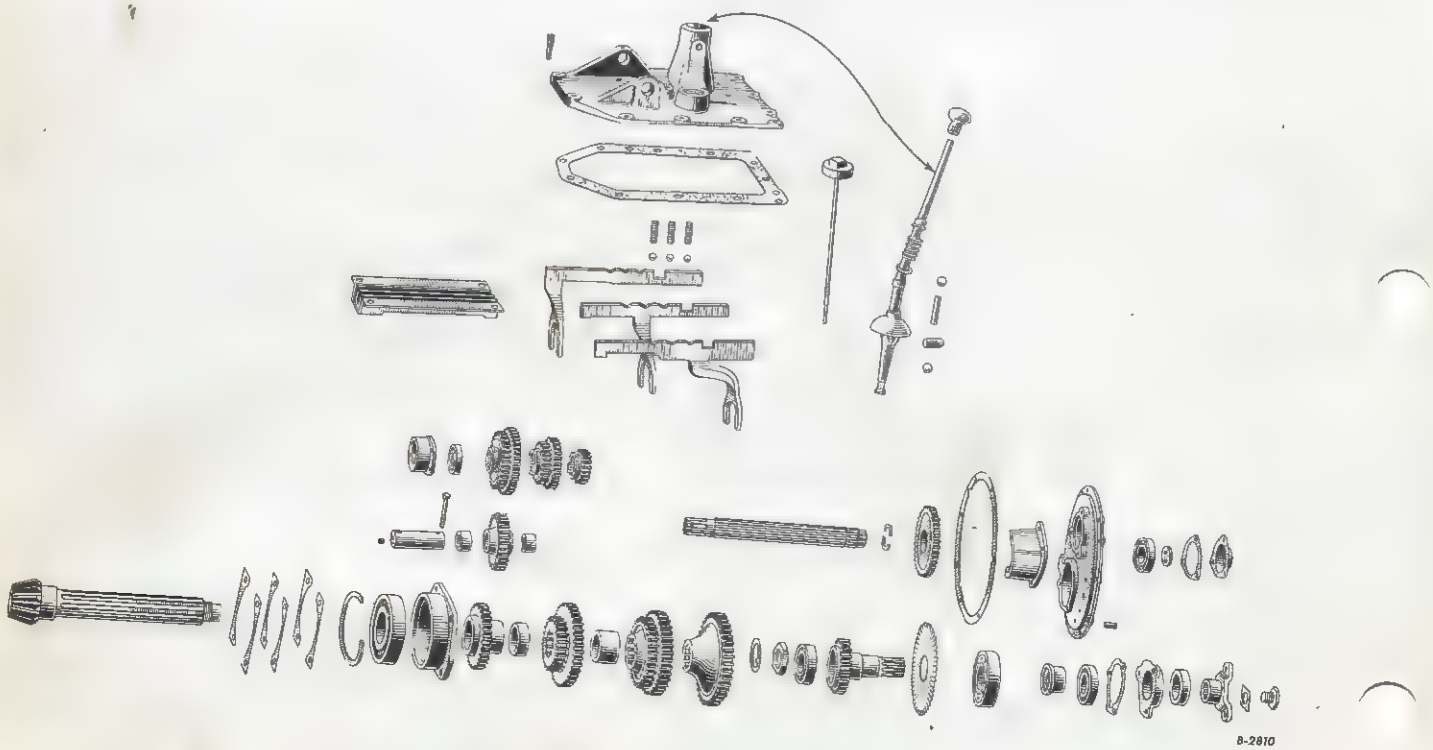
CRAWLER TRACTORS T-6 AND TD-6.

Refer to Service Charts in center of this Manual and Illust. 80A

DISASSEMBLY

Disassemble the transmission on the above models as follows:

1. Remove the seat, the steering clutch controls and the engine clutch assembly. Removal of the engine clutch is covered completely in Manual No. 10 of the



Illust. 80A--Exploded view of crawler tractor transmission.

Blue Ribbon Service Training Course form CHS-62.

2. Remove the power take-off or belt pulley attachment if so equipped.

3. Drain the transmission lubricant and clean the dirt from the transmission and rear frame cover. Remove the cover with care to prevent distortion of the shifter forks and rails which are attached to the cover.

4. Remove the upper or spline shaft front bearing retainer cap (three 3/8 inch cap screws) and bearing retainer washer (two 7/16 inch cap screws).

5. Remove the transmission front end cover which is secured with four 3/8 inch studs and nuts, four 3/8 inch cap screws, and one 3/8 inch dowel pin.

6. Place three 3/8 inch 16-thread long threaded cap screws in the threaded holes in the bolt circle of the cover. Tighten the bolts evenly to pull the cover. The transmission drive shaft assembly and the spline shaft front bearing are mounted in this cover. All are removed with the cover.

Disassemble the transmission drive shaft as follows:

1. Spread the lock and remove the drive coupling retainer screw. Remove the coupling and the bearing retainer with the oil seal. Press the shaft out of the front bearing.

2. Remove the spacer, rear bearing, and oil flinger.

3. Remove the front bearing from the cover.

4. Remove the 3/8 inch cap screws from the spline shaft rear bearing cages and remove the spline shaft.

5. Remove the 3/8 inch bolt and nut which retain the idler shaft. Slip out the idler shaft. Idler gear bushings are furnished for service reamed to size for .003 to .006 inch clearance on the idler shaft. Care must be used when installing to prevent damage to the bushing bore.

6. Remove the four 1/2 inch cap screws from the pinion shaft bearing cage. Remove the pinion shaft. Shims will be found between this cage and the frame. They are used to adjust the mesh of the pinion in the bevel gear and should be replaced in the same order as found if no bevel pinion adjustment is necessary.

7. The gears are slid off the spline shaft after removing the driven gear and its split collar. The pinion shaft gears are removed after removing the front bearing and retaining lock nut.

Cleaning Ball Bearings

Ball bearing cleaning and inspection procedures are as outlined on page 79.

ASSEMBLY

When reassembling the transmission on the above models the foregoing procedure is reversed. Shims for pinion adjustment are the split type. Be sure the same thickness is used in each half of the pack. Bevel gears on crawler tractor since serial number 10323 are stamped with the actual decimal dimension for setting the pinions. This dimension is measured with the pinion shaft bolted in position. Use a gauge between the end of the pinion and the ground portion of the bevel gear adjacent to the bevel gear spacer. On earlier production crawler tractors where bevel gears are not stamped, use a .625 inch gauge for an approximate setting and test the mesh with red lead for proper tooth contact.

When replacing the transmission cover be sure that the shifter forks engage the grooves of their respective gears and are not bent or sprung out of alignment, thus preventing full engagement of gears.

TRACTOR-ENGINE-OVER-AXLE UNITS IU-6 AND IUD-6

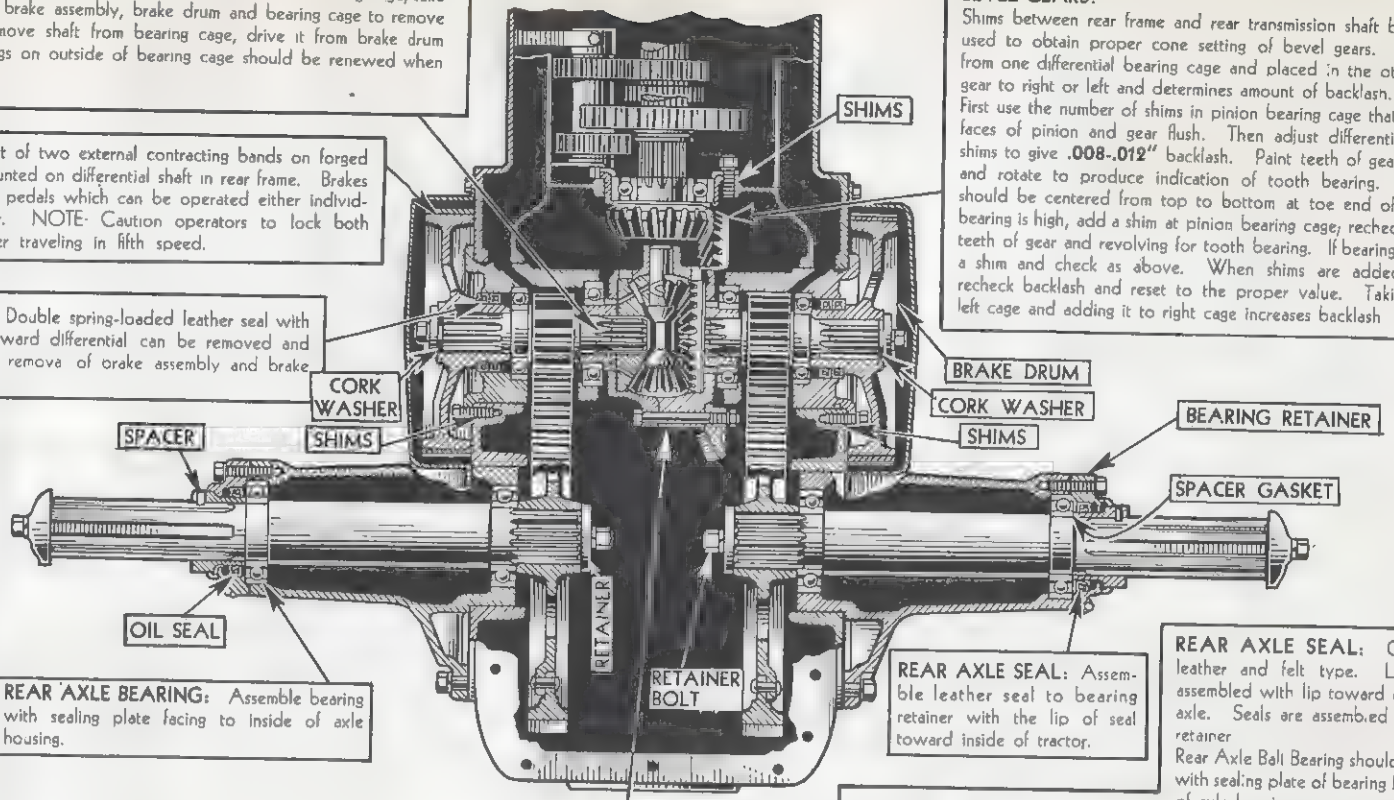
Transmissions are similar to those on the wheel tractors. Transmission disassembly requires the removal of the engine assembly which is mounted on the rear frame cover, and, the removal of the transmission to engine drive assembly. The last-named assembly is supplied by the different manufacturers who use engine-over-axle units in their completed machines. The methods of removal will differ. Removal of transmission shafts and gears follows the same procedure as given for wheel tractors (see page 79).

DIFFERENTIAL SHAFT: Shaft is mounted within differential bearing cage; take off rear axle, drive gear, brake assembly, brake drum and bearing cage to remove from rear frame. To remove shaft from bearing cage, drive it from brake drum end. Rubber sealing rings on outside of bearing cage should be renewed when reassembling.

BRAKES: Brakes consist of two external contracting bands on forged steel drums which are mounted on differential shaft in rear frame. Brakes are applied by two foot pedals which can be operated either individually or locked together. NOTE: Caution operators to lock both pedals together whenever traveling in fifth speed.

OIL SEAL: Double spring-loaded leather seal with lips turned toward differential can be removed and replaced after removal of brake assembly and brake drum.

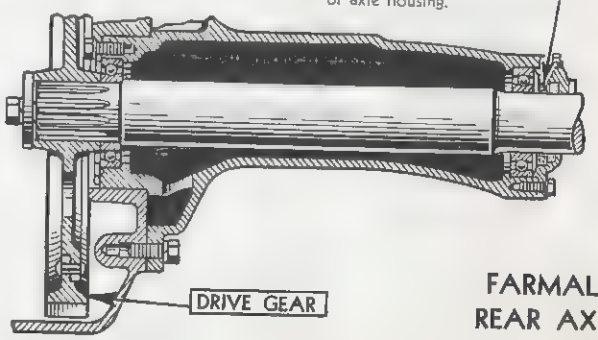
BEVEL GEARS:
Shims between rear frame and rear transmission shaft bearing cage are used to obtain proper cone setting of bevel gears. Shims removed from one differential bearing cage and placed in the other shifts bevel gear to right or left and determines amount of backlash.
First use the number of shims in pinion bearing cage that will make back faces of pinion and gear flush. Then adjust differential bearing cage shims to give **.008-.012"** backlash. Paint teeth of gear with red lead and rotate to produce indication of tooth bearing. Tooth bearing should be centered from top to bottom at toe end of tooth. If the bearing is high, add a shim at pinion bearing cage; recheck by repainting teeth of gear and revolving for tooth bearing. If bearing is low, remove a shim and check as above. When shims are added or removed, recheck backlash and reset to the proper value. Taking a shim from left cage and adding it to right cage increases backlash



REAR AXLE BEARING: Assemble bearing with sealing plate facing to inside of axle housing.

REAR AXLE SEAL: Assemble leather seal to bearing retainer with the lip of seal toward inside of tractor.

REAR AXLE SEAL: Consists of a leather and felt type. Leather seal is assembled with lip toward outside end of axle. Seals are assembled within bearing retainer
Rear Axle Ball Bearing should be assembled with sealing plate of bearing facing to inside of axle housing.



FARMALL REAR AXLE

B-1617

DIFFERENTIAL ASSEMBLY: Four-pinion type differential is mounted in a two-piece case. Fastening bolts also attach bevel gear to case. Ball bearings on each side of case have outer race fitting in differential shaft bearing cages. To remove assembly it is necessary to remove transmission cover, etc., rear axle from drive gear, brake assembly, and brake drums. Remove cap screws from differential bearing cages and use same cap screws in tapped holes in cage to pull cage from frame. When reassembling, attach left-hand shaft and cage and tighten cap screws. Then assemble differential unit to left-hand cage. Now assemble right-hand shaft and cage. Draw up right-hand cage. Clearance between cage and frame is the distance to be made up with shims. Divide up shims, with light, medium and heavy, and place an equal number between each bearing cage and main frame. Differential should rotate freely, with a minimum amount of end play. Insufficient shims will pre-load the bearings and cause rapid wear.
If shims have not been disturbed, replace same number of each as removed. Backlash of bevel gear is increased by taking a shim from left cage and adding it to right cage. See bevel gear caption for proper cone setting. After completing these adjustments, reassemble drive gear, rear axle, transmission cover, etc.

Illust. 82A--Differential and rear axle of Farmall and "6" series wheel tractors except Farmall-MV and MDV. **(See page 99 for Farmall-MV and MDV chart).**

DIFFERENTIAL AND DRIVE BEVEL GEARS

DESCRIPTION

All wheel type tractors and tractor-engine-over-axle units of the "6" series have the same differential and drive bevel gear construction. A four-pinion spider and bevel gears are enclosed in a two-piece case. The drive bevel gear and differential case halves are held in assembly by eight 1/2 inch bolts. The differential is mounted on two ball bearings in the bull pinion shaft cages. Lateral adjustment of the drive bevel gear is made by adjustment of the shims used between the bull pinion shaft cages and the rear frame. The final drive bull pinion shafts being splined are driven directly by the differential bevel gears.

Crawler tractors have steering clutches in their final drives to steer and compensate the movement of the tracks when turning or moving in a curve; therefore, a differential gear assembly is not used. The drive bevel gear is flange and spline mounted on a hub, and is carried on two ball bearings mounted in cages in the rear frame.

Lateral adjustment of the drive bevel gear is made by the use of shims between the bevel gear and its flanged spacer. Extreme deflection of the bevel gear, when operating under overloads, is prevented by use of a flat-faced 5/8 inch set screw mounted in the rear frame. Normal clearance between the deflection set screw and the back face of the bevel gear is .020 inch. The gear makes contact with the set screw only at times of extreme overload when the bevel gear is deflected away from the pinion. The drive bevel gear hub is splined internally to drive each steering clutch shaft.

FARMALL-M SERIES, WHEEL TRACTORS "6" SERIES AND TRACTOR-ENGINE-OVER-AXLE UNITS "6" SERIES.

DIFFERENTIAL DISASSEMBLY

1. Drain the lubricant from the rear frame. Clean and remove rear frame cover and the brake housing assemblies. Block the rear frame securely.

2. Remove the bull gear retaining cap screws (3/4 inch) and washers. Clean and remove the rear axle and housing assemblies.

Tractor-engine-over-axle units do not have retaining screws and washers for bull gears. Axle splines extend through the bull gears and axle ends are joined with an internally splined sleeve. This sleeve locks the axles together and acts as a spacer between the bull gears.

3. After the axle and housing assemblies are removed, the bull gears may be lifted out of the frame. Remove the brake drum retaining cap screws (5/8 inch), washers and cork seal gaskets. Slip off the brake drums.

4. Remove the six 7/16 inch cap screws from each bull pinion bearing cage. Use two of these screws in the tapped holes to pull the assemblies. This releases the differential assembly. The shim packs found between each cage and the rear frame are used to adjust end play in the differential case and to adjust the back lash of the drive bevel gear in the pinion.

5. The drive bevel gear is attached to the differential case with the same bolts (eight, 1/2 inch) which hold the halves of the case together. Mark the halves to aid in assembly to the same position. Clean and examine all parts. Be sure they are fit for reinstallation. Refer to page 79 for information on cleaning ball bearings.

DIFFERENTIAL ASSEMBLY

1. Dip the differential pinions and gears in clean, light oil when assembling them in the case.

2. Mount the drive bevel gear and bolt the assembly. Be sure the drive bevel gear is firmly seated against the case flange, and that the differential gears turn freely within the case after all case bolts are tight.

3. Attach the left-hand bull pinion and cage assembly to the rear frame.

4. Install the differential unit and the right-hand bull pinion and cage assembly. Use the original shim packs with each case if they have not been disturbed. If the shims have been disturbed proceed as follows:

a. Attach both cage assemblies without shims. Tighten the left-hand cage securely.

b. Draw up the right-hand cage evenly until rotation of differential unit is free without end play.

c. The gap between the flange of the right-hand cage and the outside of the frame is the amount of shims required. Divide the selected shims (light, medium and heavy). Use an equal number of each for each cage.

d. Assuming the drive pinion is properly set, shims can be taken from one cage and added to the other to obtain the necessary .008 to .012 inch backlash. Taking a shim from the left cage and adding it to the right cage increases the backlash between the drive gear teeth. Tooth bearing is determined by the position of the pinion. When installing a new matched set of gear and pinion, arrange the shims for a red lead or prussian blue check so that the backs of the gears are flush and the backlash of the teeth is .010 inch. Details on proper tooth bearing are found under "Setting Bevel Gears" page 85.

CRAWLER TRACTOR "6" SERIES

DRIVE BEVEL GEAR DISASSEMBLY

Drive bevel gear disassembly necessitates the removal of both steering clutches. For this operation refer to page 94. After the steering clutches have been removed proceed as follows:

1. Spread the locks and remove the four bolts from the bevel gear spacer flange. Drive bevel gear cages are removed by inserting three long-threaded 3/8 inch cap screws in the tapped holes provided. Tighten each screw evenly to pull the cage. Cages are left and right hand. The right-hand cage has a small flange on its inside diameter to retain the ball bearing. The left-hand cage bore is smooth to allow its bearing to float.

2. Slip the bevel gear hub to the right, out of the bevel gear and spacer. Lift out the bevel gear.

3. Save the shims found between the bevel gear and the spacer flange. These shims are used for lateral adjustment of the bevel gears to insure proper backlash. Clean and examine all parts as to fitness for reinstallation. Refer to page 79 for information on cleaning ball bearings.

DRIVE BEVEL GEAR ASSEMBLY

Drive Bevel Gear Assembly is made in the following sequence:

1. Press the right-hand bearing into the right-hand bearing cage. This is the cage which has the flange on its inside diameter. The bearing has a wider inner race. The flush side of the race of this bearing faces to the right. See service chart, page 102.

2. Press the right-hand bearing cage and bearing onto the bevel gear hub. Secure with the steering clutch coupling using the six cap screws. Do not bend the locks.

3. Back out the deflection set screw two or three turns.

4. Lower the bevel gear into its compartment. Slide the hub through the bevel gear from the right side and secure the right-hand bearing cage; secure cap with the nuts and cap screws.

5. Slide the shims and spacer over the hub from the left-hand side. Use the same number of shims which were removed or a trial pack consisting of four heavy and four or five light shims.

6. Assemble the left bearing to the left-hand cage with the flush side of the bearing races faced to the right-hand side.

7. Mount the bearing and cage to the main frame and bevel gear hub. Secure them with the clutch coupling and the bearing cap. Do not bend the cap screw locks.

8. Assuming the drive pinion is properly set, add or remove shims from the bevel gear and spacer to give .010 to .012 inch backlash between the pinion and the bevel gear teeth. Be sure all bolts of the assembly are tight when checking backlash.

9. Adjust the deflection screw on the right side to .020 inch clearance between it and the back face of the bevel gear. Lock the screw in this position.

Mated and Unmated Bevel Gears

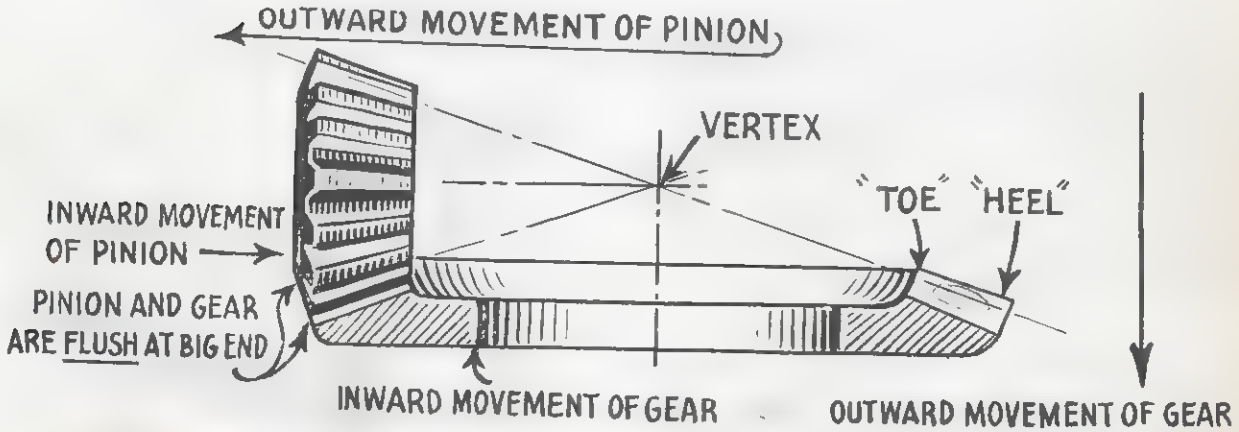
Matched and mated drive bevel pinions and drive bevel gears are now furnished for service and production. These were first used in production on crawler tractor serial number 10323. Mated gears are marked with figures showing the distance from the end of the drive bevel pinion to the ground surface on the bevel gear. These markings (in thousandths of an inch) are found on the gear end of the bevel pinion.

Adjust the number of shims between the bevel pinion bearing cage and the main frame to accommodate a gauge of the thickness indicated between the end of the pinion and the ground surface of the bevel gear when all bolts are tight in the complete assembly. Refer to service charts on pages 102 and 103.

Adjust the drive bevel gear shims to give .010 to .012 inch backlash when all bolts are tight in the complete assembly. Adjust the deflection screw to give .020 inch clearance between it and the back face of the bevel gear. Lock the screw in this position. Test tooth bearing with red lead.

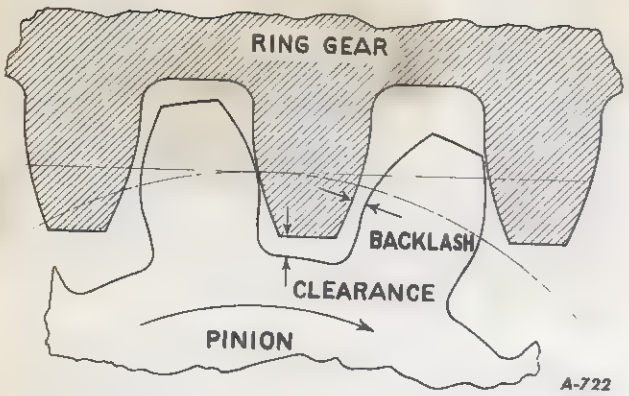
Unmated drive bevel pinion and gears on which markings for adjustment do not appear are adjusted by checking the tooth bearing with red lead or prussian blue as outlined in "Setting Bevel Gears" below. A pinion to bevel gear hub measurement of .625 inch is used as a trial setting. The final setting is determined by actual tooth bearing or contact as shown by the use of red lead.

SETTING BEVEL GEARS

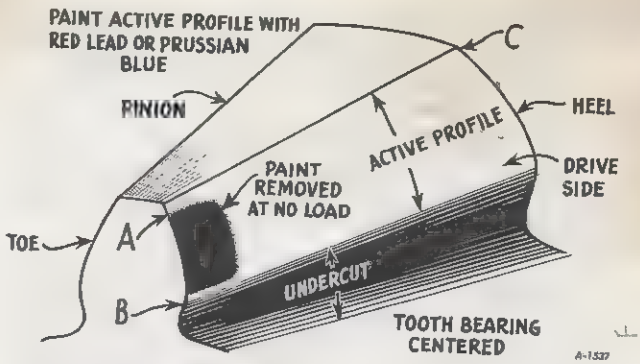


Illust. 85A--Pitch lines of bevel gears form cones which meet at the vertex when properly adjusted.

The operation of a perfectly mated pinion and bevel gear is shown in illust. 85A. The broken lines are extended from the contact centers or pitch line of the gear teeth and form two perfect cones. The lines from contacting teeth lie in the same plane. The vertexes of the cones meet. This is in effect



Illust. 86A--The arrows above indicate the backlash and clearance produced by adjusting the ring gear out, away from the pinion. To reduce the amount of backlash, move the gear in, toward the pinion.



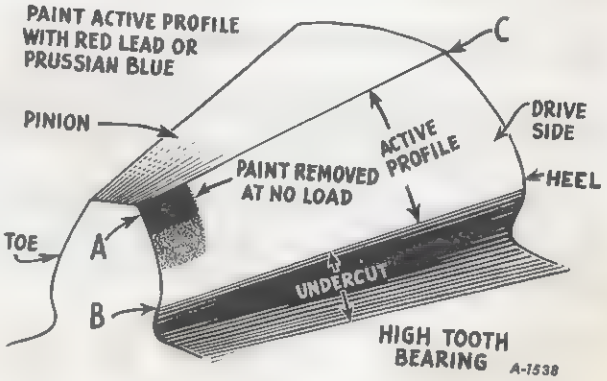
Illust. 86B--Tooth bearing should be centered between "A" and "B." Gears should operate quietly with this type of contact. When a load is placed on the gears the tooth contact will extend from the toe towards the heel of the teeth.

two perfectly matched and adjusted cones rolling together. Bevel pinions and gears are mounted with provisions for adjusting the gears inward or outward to secure perfect mating of these pitch lines.

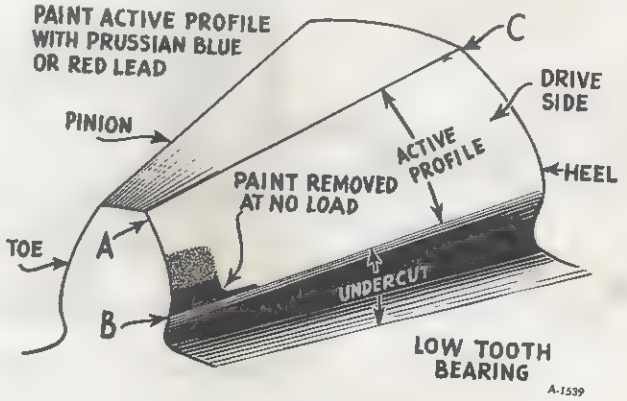
Since these pitch line cones cannot be seen and compared during the adjustment of the gear setting, dependence must be placed in tooth bearing made visible by lightly painting the teeth and in measurement of backlash between meshed teeth.

Improperly adjusted gears are noisy in operation. They will not wear in nor will they improve with use. If allowed to operate over a period of time in this condition there is little possibility of their ever operating quietly even after an attempt is made to reset them. The responsibility is with the serviceman to do a perfect job every time. Use only matched sets of gears for replacement purposes. Take the time to set them properly and the life and efficiency of the parts will be materially increased.

If the pinion setting is not marked on that gear, adjust the pinion so that the "heel" or large end of the pinion and the gear teeth are flush. Adjust the bevel gear to give the specified backlash. Using a dial indicator against a gear tooth, hold the pinion stationary and rock the gear to measure this backlash. See illust. 86A. While this is only a trial setting, all bearing cages and shim packs must be bolted up tight to give an accurate picture of tooth bearing and backlash.



Illust. 86C--High tooth bearing at "A" shows that the pinion has been set too far in (no load). To correct this bearing, move the pinion out (arrow in illust. 85A) and then move ring gear in for proper backlash, if necessary.



Illust. 86D--Low tooth bearing at "B" shows that the pinion has been set too far out (no load). To correct this bearing, move the pinion in (arrow in illust. 85A) and then move ring gear out for proper backlash, if necessary.

Gears and teeth should be clean and free from oil. Powdered red lead mixed with a slight amount of oil makes an excellent painting material. Tests have proven it is easier to analyze tooth bearing when the pinion is painted with the red lead and not the ring gear, since the pinion revolves oftener and makes contact with more teeth to give a better average bearing.

The most satisfactory method for revolving the drive gears is to jack up the tractor, push the fifth speed gear into engagement, engage the clutch, remove the spark plugs and crank the engine. Use the brakes, if possible, to slightly load the gears.

Inspect the teeth of the pinion to discover where the paint has been removed by contact with the bevel gear. Illusts. 86B, 86C and 86D show three possible results. Illust. 86B shows the ideal tooth bearing. Notice that the tooth bearing point is at the "toe" end of teeth. This is normal when the gears are operated under light or no load. It is impossible to make the bevel gear and pinion mountings so rigid that there will be no deflection under heavy load. This deflection allows the "toe" bearing to spread out toward the "heel" as the load is increased. Illust. 86C shows a high bearing toward the point "A" of the pinion tooth. This indicates the pinion is in too far and must be withdrawn slightly by adjusting the pinion shims. The bevel gear must be moved in to maintain the proper backlash. Tighten all bolts. Clean paint markings from the teeth and repaint the pinion for further test.

Illust. 86D shows the other extreme of pinion adjustment. This shows a low bearing toward the point "B" of the pinion tooth and indicates the pinion is OUT too far. As the pinion is brought in by shim adjustment the bevel gear must be moved out to maintain the backlash. Be sure all bolts are tight before retesting with fresh paint.

Being able to recognize a high or low tooth bearing requires practice and close observation. Do not be concerned with the amount of paint removed along the tooth from "A" to "C" but rather with the point at which it is removed between "A" and "B"! With the bevel gear set to give the specified backlash, the tooth bearing from "A" to "C" will take care of itself as the load and power is applied causing slight deflection of the gears.

All bevel gear and pinion adjustments should be checked by the paint method even if marked gears are carefully set according to their markings. This prevents any mistakes and insures quiet operation and long gear life. When a satisfactory tooth bearing and backlash adjustment is obtained the bolt lock strips are set to prevent loosening.

BRAKES

SPECIFICATIONS

Brake drum diameter
- Wheel tractors ..... 11-1/2 in.
- Crawler tractors ..... 12-1/8 in.

Brake band width
- Wheel tractors ..... 2 in.
- Crawler tractors ..... 2-1/4 in.

Brake band rivets

	Size	Quantity
Wheel tractors...	.146 x 1/4	36
Crawler tractors.	.186 x 3/8	64
	.186 x 1/2	8

WHEEL TRACTORS

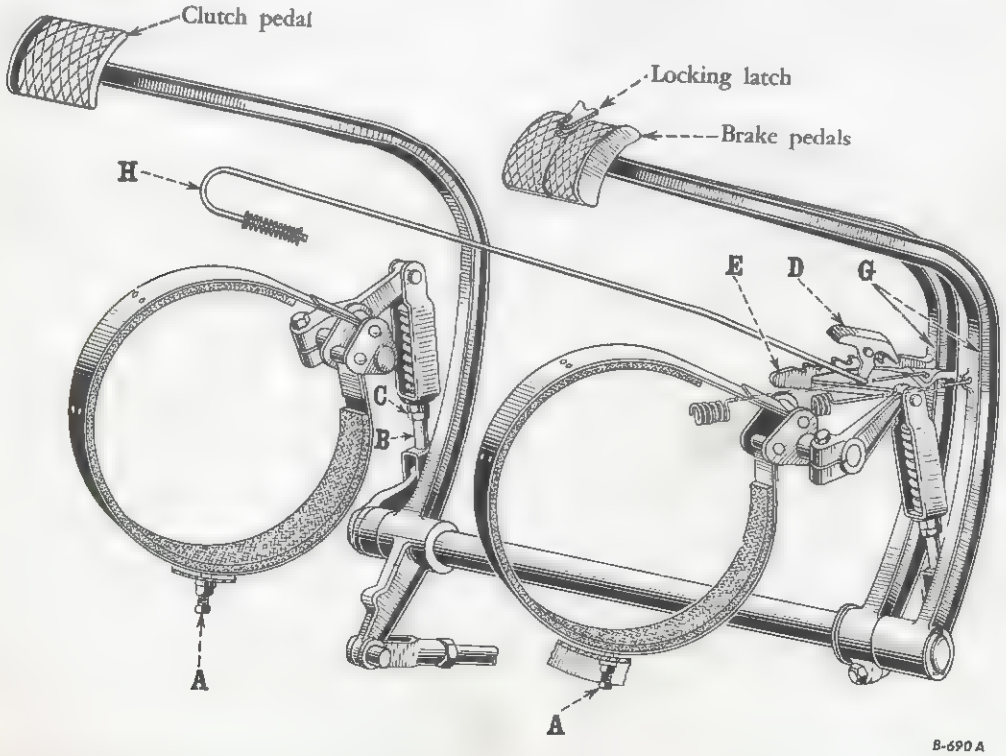
Description

Brakes are external contracting bands on heavy drums. Brake drums are mounted on splined ends of bull pinion shafts. All are inclosed in pressed steel housings. Brakes are operated by foot pedals. A latch is provided to lock the brakes for parking. In addition to the parking latch all wheel tractors excepting the orchard types have a lock plate which enables the operator to lock the right and left-hand brake pedals together for use on the road for high traveling speeds.

Adjustment

The brakes should not drag and they should not require excessive travel of the pedals before they take hold. The pedals should have a free movement of approximately 1-1/2 inches measured at the pedal stops; or, just enough movement so that only a slight pressure is required to push the pedals to the first notch of the parking latch. Start adjustment by turning up the set screw in the bottom of brake housing as far as it will go, then back off the set screw a quarter to a half turn and set the lock nut. Secure correct free pedal movement by changing the length of the brake rod. Loosen the lock nut and remove the pin from the clevis. Turn the clevis right or left.

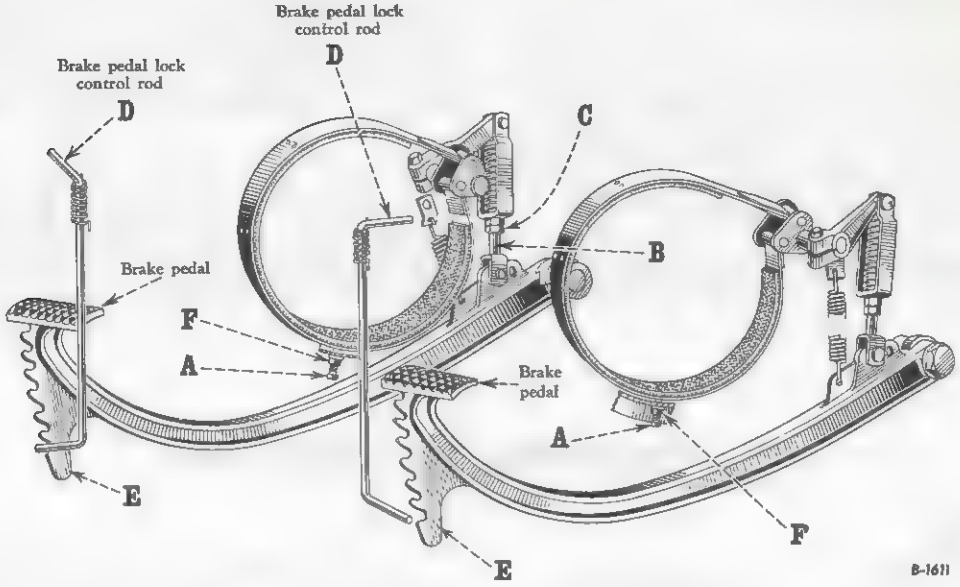
When each brake is adjusted to obtain the same free movement of the pedals, test by jacking up both rear wheels. Operate the tractor in third or fourth gear and apply the brakes. Both wheels



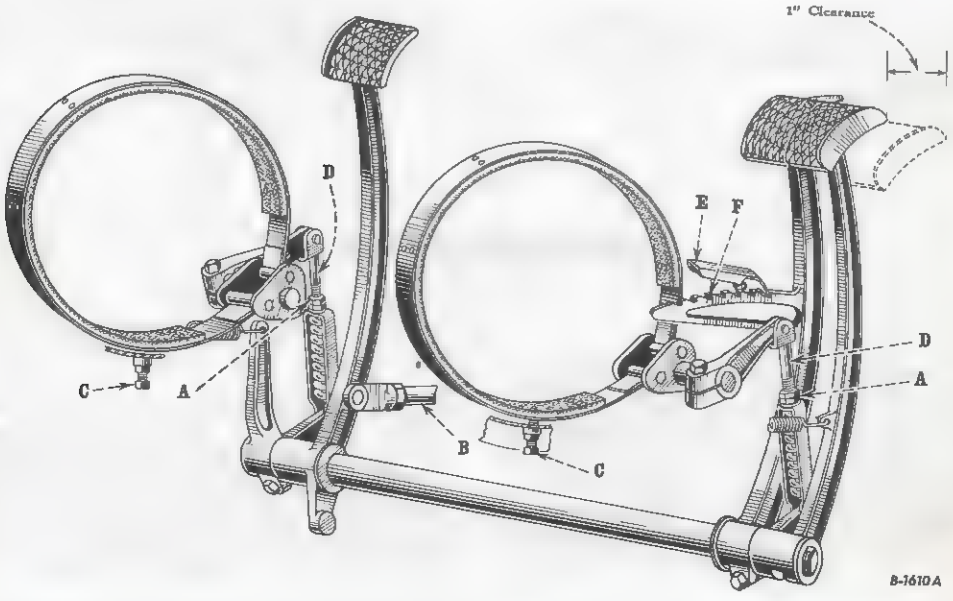
Illust. 88A--Tractor models "W" and "I" brake system: (A) set screw; (B) brake rod; (C) brake rod jam nut; (D) brake lock; (E) rack; (B) brake pedals; (H) lock.

should slow down at the same time. Should one wheel stop and the other continue to revolve, loosen the adjustment on the wheel that stops until both wheels continue to revolve.

If the tractor is mounted on pneumatic tires a road test may be made. In this test, loosen the brake which causes one of the wheels to skid. See illusts. 88A, 89A and 89B.



Illust. 89A--O-6 brakes showing (A) set screw; (B) brake rod; (C) brake rod jam nut; (D) brake lock; (E) rack; (F) set screw jam nut.



Illust. 89B--Farmalls M and MV brakes, showing (A) brake rod jam nut; (B) clutch operating rod; (C) set screw; (D) brake rod; (E) brake lock; (F) rack.

Removal and Replacement

Remove the brake assemblies in the following sequence:

1. Pull pin from brake rod and arm.

2. Remove the seven 3/8 inch cap screws from the brake housing.

3. The band and lever assembly is removed with the housing.

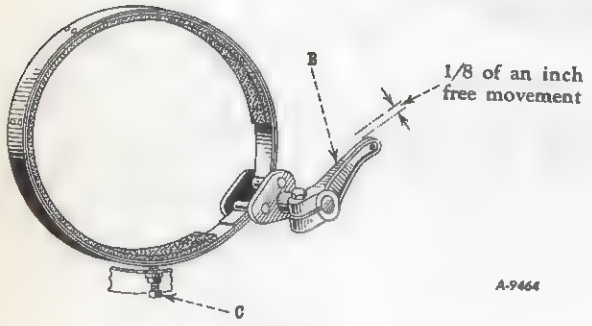
4. If the linings are worn or grease covered, replace the linings. Be careful not to distort the bands while relining. The lining rivets must be well clinched with the heads pulled down into the countersunk holes in the lining to prevent damage to the drums.

If oil leakage has occurred from bull pinion shafts; Remove the 5/8 inch drum retainer cap screw washer and cork gasket. Slide the drum from the shaft. Pry out the double seal and install the new seal. The lips of this seal face inward. Clean and replace the drum. Use new cork gasket to seal the drum hub and the spline shaft.

Before replacing the band and housing assembly, check the band for distortion by placing a drum in the band and moving the band lever to set the band on the drum. If the band is not sprung, it will tighten on the drum without flexing at any one point. Correct any distortion, install assemblies and adjust.

The brake pedal cross shaft used on all models except orchard types, is sealed at each side of the main frame with spring-loaded leather seals. These are installed with lips facing inward.

TRACTOR-ENGINE-OVER-AXLE UNIT



Illust. 90A--Tractor-engine-over-axle unit brake adjustment.

The brakes are similar to the above, except that pedals and linkage vary with the using manufacturer. To check free movement, measure the travel of the brake band lever arm (1/8 inch is sufficient, measured at the pin hole as shown in illust. 90A).

Removal and replacement of the brake band and drums on the tractor-engine-over-axle units follow the same procedure as for wheel tractors.

CRAWLER TRACTOR

Description

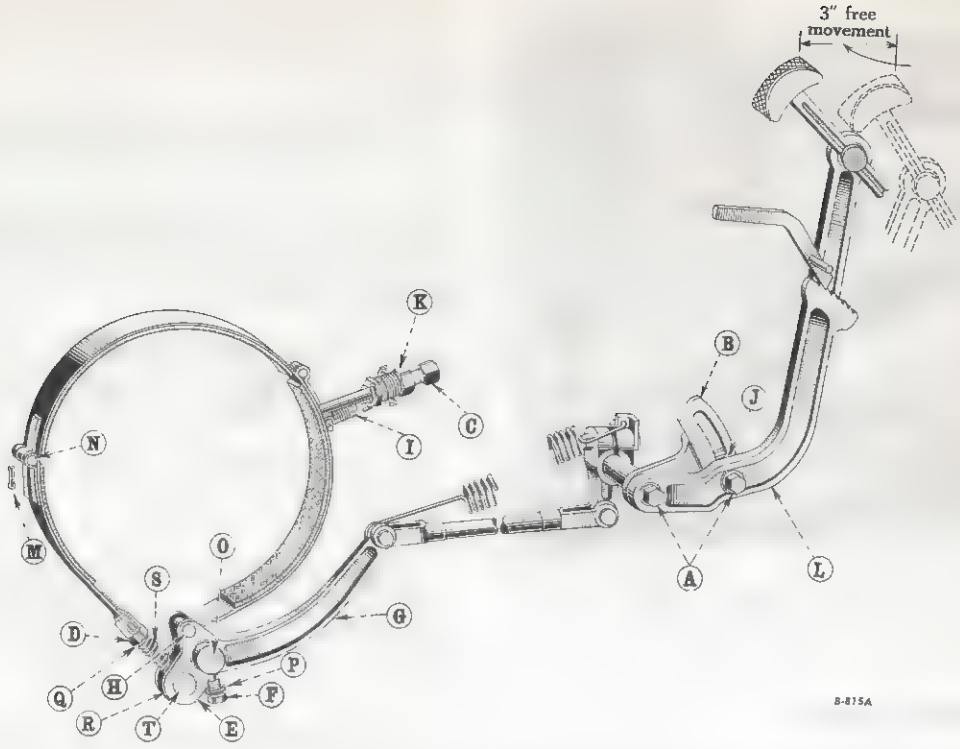
The brakes are the simple, accessible, external contracting band type and operate on the outside of the steering clutch drums. Each brake is controlled independently by a foot pedal. Both pedals are adjustable to suit the operator and each can be locked by latches for parking.

Adjustment

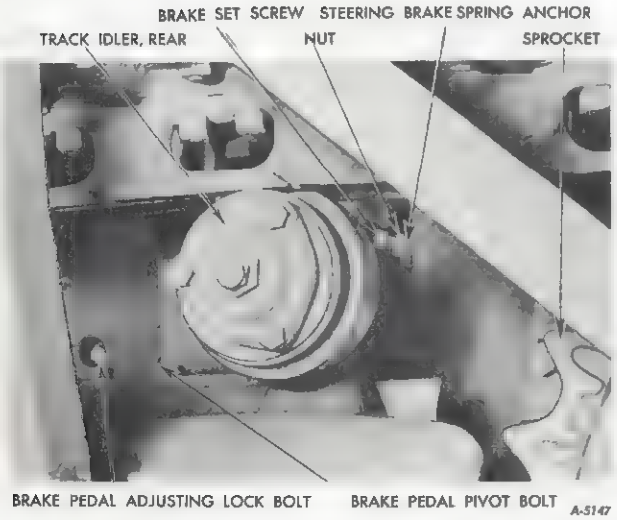
Each brake pedal should have a free movement of approximately 3 inches. When adjustment is necessary, proceed as follows:

1. Remove the foot rest and wedge a small pry bar between the adjuster "B" (illust. 91A) and the main frame. Loosen the lock screw and the pivot screw "A." Two holes are provided in each main frame side channel to permit access to these cap screws (illust. 91B).

2. With the cap screws loose, move the adjuster downward in relation to the pedal. The adjuster "B" and the lock



Illust. 91A--Crawler tractor steering brakes and controls.



Illust. 91B--External points for adjusting steering brakes.

collar "J" are notched. Hold the adjuster to the new position on the pedal and tighten the two cap screws "A."

3. Check the pedal free movement and if correct replace the foot rests.

When the adjuster "B" has been adjusted to its limit downward and no further adjustment can be secured proceed as follows:

1. Loosen the lock screw and pivot screws "A" and pull the adjuster "B" as far up as possible in relation to the pedal. Tighten the screw "A."

2. Remove the steering clutch inspection cover from the top of the main frame cover. Loosen the jam nut "K" and turn the set screw "C" until there is a clearance of 1/64 inch between the band lining and the drum at that point. Tighten the jam nut.

3. Remove the steering brake inspection cover from the bottom of the main frame (illust. 92A). Loosen the lock nut "D" (illust. 91A) and turn the adjusting bolt "E" until the clearance between the band lining and the drum is 1/64 inch at that point. Tighten the lock nut.

4. Replace the upper and lower inspection covers and adjust the brake pedal free movement as described previously.

Illust. 92A--Steering brake, lower inspection covers and drain holes.

Removal and Replacement

The brake linings should be replaced before they are worn to the point where rivets score the drum. Oil soaked linings are also replaced as they cannot be salvaged.

1. Remove the upper and lower inspection covers and foot rest. Loosen the jam nut "K" and remove the set screw "C."

2. Separate the rear and center sections of the brake band by removing the cotter pin "M" and push out the pin "N."

3. Remove the pipe plug from the lower outside of the main frame in line with the pivot shaft "O." Remove the pivot shaft stud "F" and insert a short punch into the pipe plug hole and drive the pivot shaft out of the lever. Remove the shaft from the inside.

4. Loosen the lock nut "D." Remove the adjusting bolt "E" with washer "Q" spacer "R" and spring "S." Remove pin "T."

5. Push the pivot lever assembly up out of the way and remove the rear section of the band from the lower inspection hole.

6. Push the brake pedal all the way down and lock it with the pedal latch.

7. From the lower inspection hole, pull the pivot lever assembly down until the joint pin "H" can be removed from the pivot lever "G".

8. Disconnect the anchor spring "I" and lift the front and center sections of the band out of the top inspection hole.

9. Replacement is made by reversing the above order.

Care should be taken during the removal and replacement to prevent distortion of the band. The same care should be taken while replacing the linings.

The lining rivets must be well clinched and heads pulled down into the countersunk holes in the lining to prevent contact with the drum.

Oil on the linings may come from excessive lubrication of the steering clutch release bearing, or from leakage of the right or left hand clutch shaft oil seals. If brake linings should become oil soaked, the steering clutch linings should also be inspected for the same condition. Correction of both is made at the same time. A drain is provided in the bottom inspection cover which prevents an accumulation of oil in the steering clutch compartment. This drain may become plugged, or a solid pipe plug may have been installed for operation under very dusty or wet conditions. When the solid plug is used in this drain hole it should be checked each 60 hours of operation. Drain out any oil leakage which may have occurred. See draining instructions in the pertinent operator's Manual.

CRAWLER TRACTOR STEERING CLUTCHES

SPECIFICATIONS

Type	Spring-loaded	Spring, free length	5-19/64 in.
Size	11 in.	Spring test - 1425 lb. when compressed to	3-19/32 in.
Friction discs	12		
Driving discs	11		

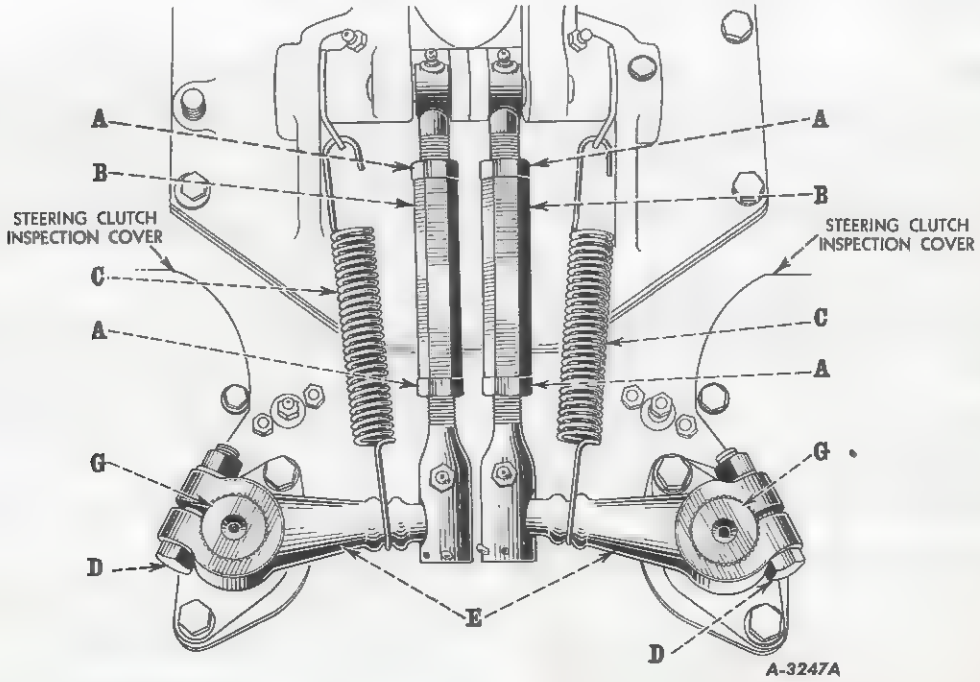
DESCRIPTION

Power from the transmission is transferred through a steering clutch on each side to the sprocket drive gears. When both steering clutches are engaged, power is transmitted equally to each track. By disengaging one clutch, all the power is applied to the other track. If the steering brake is applied to the disengaged clutch, the crawler tractor pivots on its track. Disengaging both steering clutches at the same time or disengaging the engine clutch causes the crawler tractor to stop. Refer to charts on pages 102 and 103.

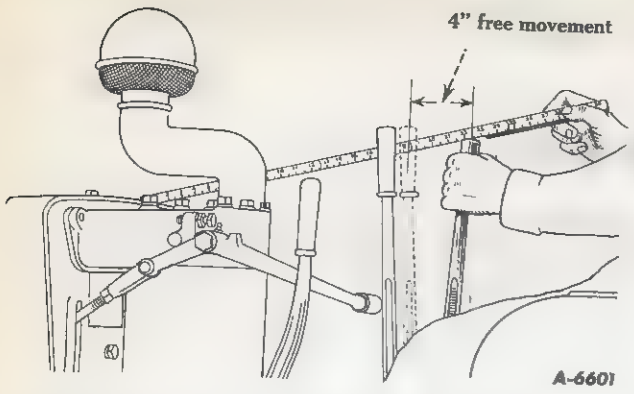
ADJUSTMENT

When the free movement of the steering clutch levers is less than 2 inches, measured at the lever handle, adjustment is necessary. Remove the seat cushion and proceed as follows:

1. Loosen the lock nuts "A" (illust. 93A) and turn the turnbuckles "B" several turns to shorten the linkage. Tighten the lock nuts against the turnbuckles.



Illust. 93A--Adjusting steering clutches.



Illust. 94A--Adjustment of steering clutch levers.

2. Check the free movement of the hand lever as shown in illust. 94A. This should be 4 inches.

If the turnbuckles are adjusted to the limit before correct free movement can be obtained, proceed as follows:

1. Remove the release spring "C" (illust. 93A), loosen the lock nuts "A", and turn the turnbuckles "B" to lengthen the linkage as much as possible.

2. Remove the lever cap screw "D," and pry the lever "E" off the splined release shaft "G", and turn the right-hand release lever counter-clockwise slightly (left-hand release lever clockwise). Replace the release lever on the splined shaft.

3. Replace the release spring "C" and shorten the linkage until free movement of 4 inches is obtained.

4. When the desired free movement is obtained, replace and tighten the lever cap screw "D" and tighten the lock nuts "A" against the turnbuckles.

REMOVAL AND REPLACEMENT

Steering clutches are removed as a complete unit, without disturbing the drive bevel gear or sprocket drive. Illusts. 95A and 96A show the construction of the clutch unit and the release fork assembly. Reference numbers in the following text refer to both illustrations. The service charts on pages 102 and 103 show the relationship of the steering clutch to the drive bevel gear and sprocket drive.

DISASSEMBLY

Remove either steering clutch as follows:

1. Drain the oil from the transmission.

2. Remove the seat frame, fenders, fuel tank and battery (if used). Be sure to disconnect the fuel lines and any electrical wiring.

3. Remove the clutch release levers "B" (illust. 96A) and the springs from the release fork shaft "G." Remove the release shaft bearing (26), and the foot rest.

4. Clean and remove the cover from the main frame.

5. Remove the release fork pivot lock (29), and the lock nut (30) from the bottom of the main frame and the release fork pivot (31).

6. Remove the release fork "G" and the pin bushings (32) from the compartment.

7. Remove the oil tube (6) from the release collar (7).

8. Pull the pin from the upper brake joint and fold the bands out of the way. Back off the brake band set screw "C" (illust. 91A).

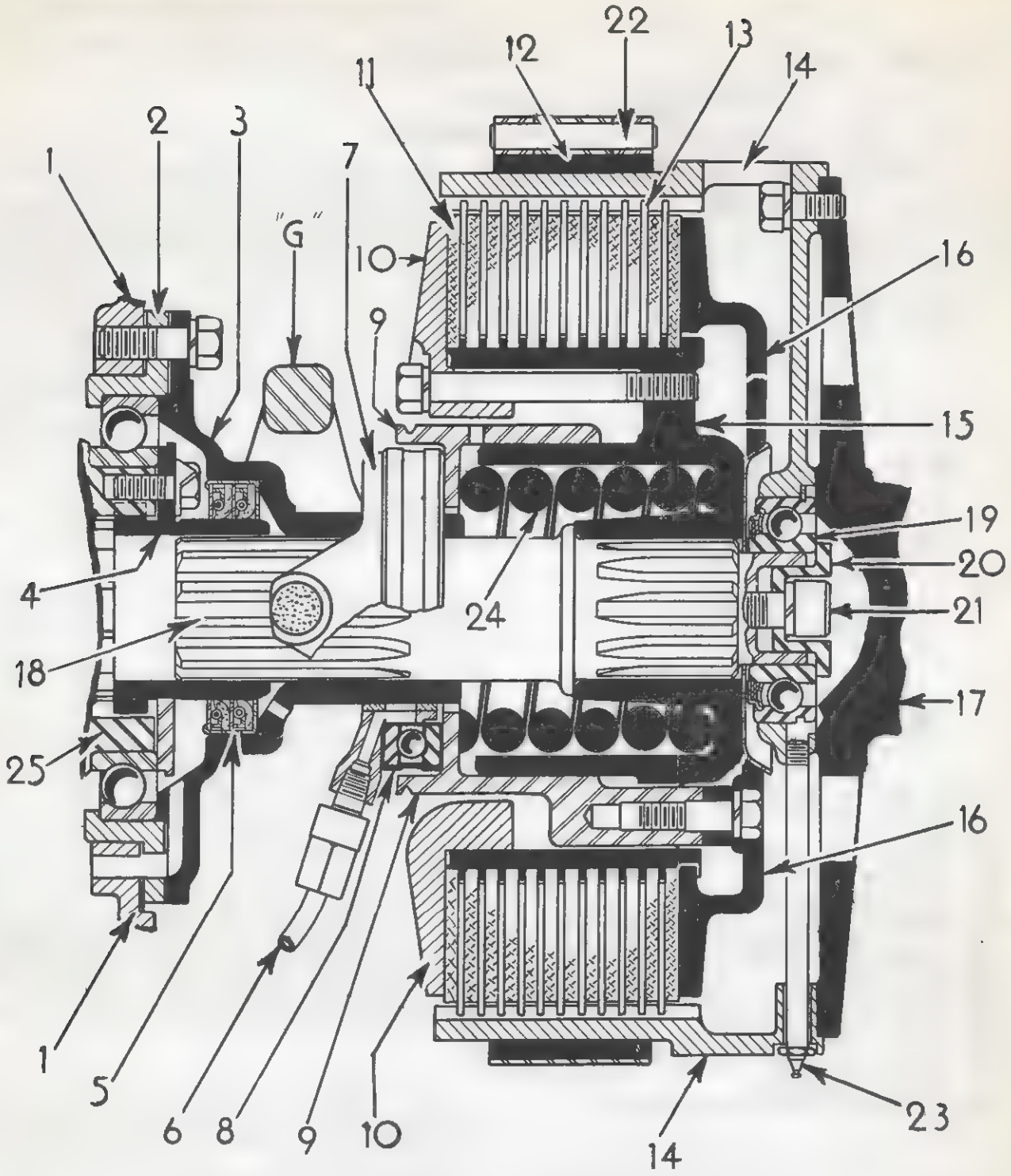
9. Remove all cap screws but two from the steering clutch drum (14, illust. 95A) and the pinion flange (17). Revolve the drum so that the two remaining cap screws are at the top. Mark both the drum and the pinion flange so that the parts will be reassembled in the same position. This saves time as both parts will fit but one way.

10. Assemble the three special compressor bolts 48389D in the hub plate (10) to compress and release the clutch. Then remove the cap screws from the bevel gear bearing cap (3) and slide the cap as far into the clutch as possible.

11. Remove the lock and cap screws from the coupling (4).

12. Put a sling around the clutch and raise the hoist just enough to take the weight off the coupling (4).

13. Remove the remaining two cap screws from the drum (14) and the pinion flange



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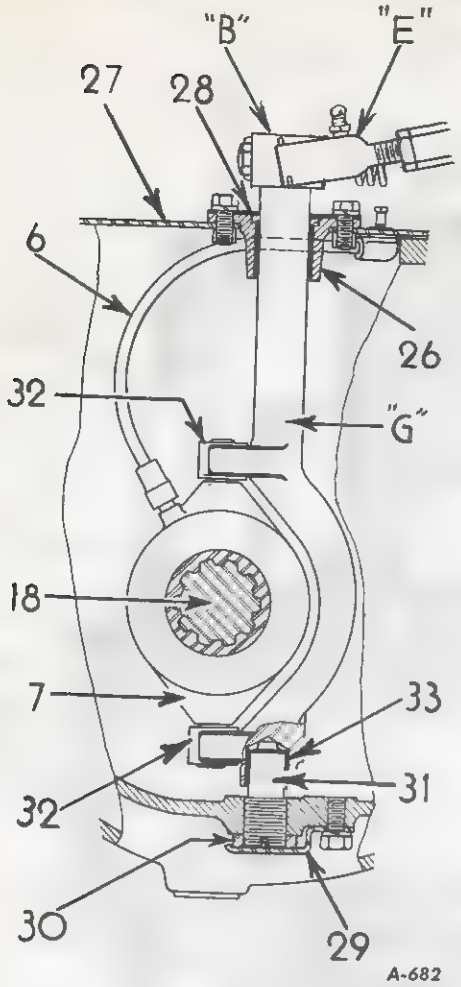
Illust. 95A--T-6 and TD-6 steering clutch assembly - (R.H.).

(G) release fork.
(1) main frame.
(2) bearing cage.
(3) bearing cap.
(4) clutch shaft coupling.
(5) double leather oil seal.
(6) release bearing oil tube.
(7) release collar.
(8) release thrust bearing.
(9) pressure spring retainer.
(10) hub plate.
(11) disc internal teeth.
(12) steering brake band.
(13) disc external teeth.
(14) steering clutch drum.
(15) steering clutch hub.
(16) pressure plate.
(17) pinion shaft (flange).
(18) steering clutch shaft. shaft.
(19) pilot bearing.
(20) pilot bearing retainer.
(21) pilot bearing retainer bolt (Allen head).
(22) brake band joint pin.
(23) pilot bearing lubricator.
(24) pressure spring.
(25) bevel gear hub.



Illust. 96A--T-6 and TD-6 steering clutch release fork assembly (L.H.).
(B) release lever.
(G) release fork and shaft.
(E) turn buckle socket.
(6) release bearing oil tube.
(7) release collar.
(18) steering clutch shaft.
(26) release shaft bearing.
(27) main frame cover.
(28) release shaft bearing felt retainer.
(29) release fork pivot lock.
(30) release fork pivot lock nut.
(31) release fork pivot.
(32) release pin bushing.
(33) release fork pivot bushing (brg.).

(17). Pry the coupling (4) into the bearing cap (3) and rock the drum from the flange (17). Raise the hoist and remove the assembly from the clutch compartment.

Complete overhauling instructions for the steering clutch units are found in Manual No. 10 of the Blue Ribbon Service Training Course, form CHS-62.

Assembly

The steering clutches are assembled by reversing the above procedure. As insurance against leakage, the oil seal (5, illust. 95A) should be replaced with a new seal. Seals should be soaked in oil for a short time only. If the leather is too soft the lips will turn upon installation of the coupling (4) into the bearing cap (3). Install the seal into the bearing cap (3) so that the lips face the bevel gear. Special cap screws are used to attach the coupling (4) to the bevel gear hub (25). They are identified by a punch mark in the center of the heads.

NOTE: Do not forget to remove the special compressor bolts 48389-D.

When replacing release fork "G," (illust. 96A) first secure the pivot (31) by only a few threads to act as a guide. Grease the end of the pivot. The prongs on the release fork "G" should be smooth and parallel. Adjust the pivot (31) to give equal vertical clearance for both bushings (32) tighten the lock nut (30) and secure with the release fork pivot lock (29). The outside and the inside of the bushings (32) are smooth, and should be free on the collar pins after the fork is assembled. A small amount of oil on the inside of the collar (7), on the collar pins and bushings (32) and on the shaft bearing (26) will help in case of release. Soak the felt washer with oil before replacing the retainer (28). Replace the release lever "B" and adjust hand lever free movement as outlined under "ADJUSTMENT" on pages 93 and 94.

The steering clutch hand lever stop screws should be set so that the top of the lever is 9 inches from the rear edge of the hood sheet. This setting permits 4 inches of free movement plus 15 inches of movement for disengagement. Less movement, not completely releasing the steering clutches, causes rapid wear.

FINAL DRIVE AND REAR AXLE

FARMALLS M AND MD
WHEEL TRACTORS W-6, WD-6, O-6, OS-6, ODS-6, I-6 AND ID-6
TRACTOR-ENGINE-OVER-AXLE UNITS IU-6 AND IUD-6

Description

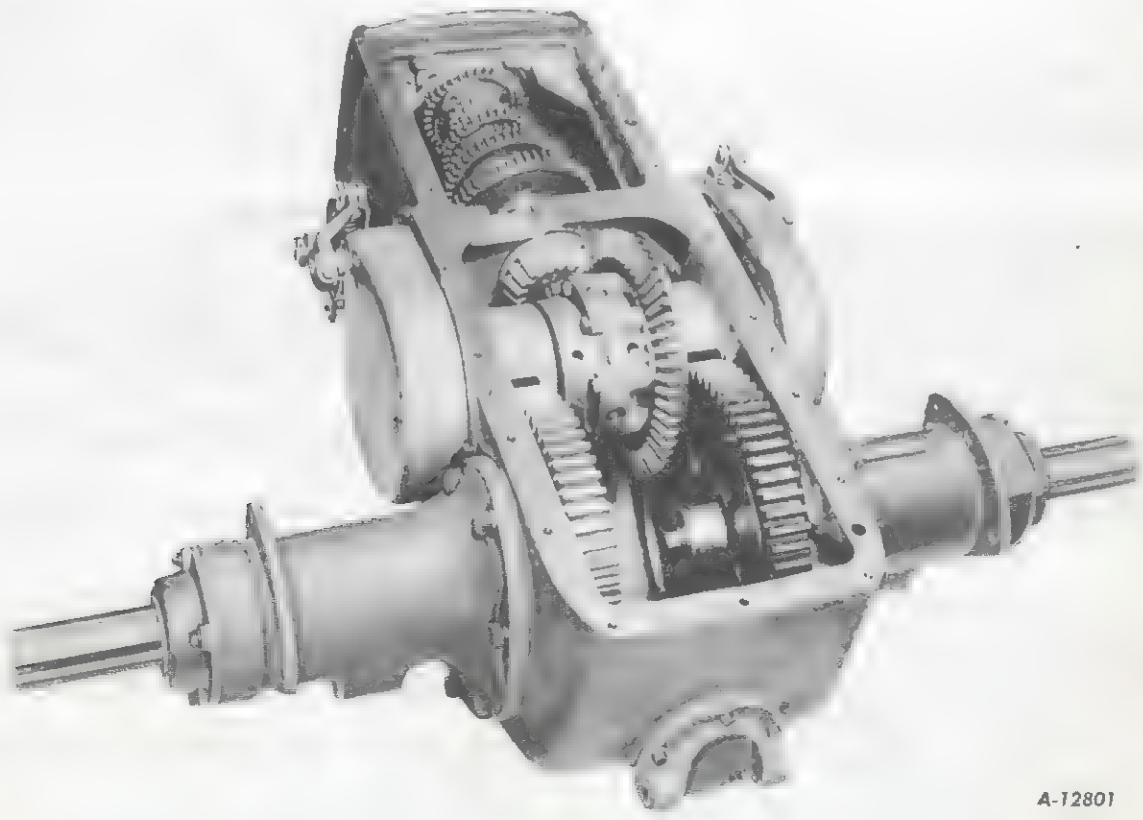
Tractors in this group have identical final drives, consisting of two 13 tooth bull pinions driving two 73 tooth bull gears. The bull pinions and their shafts are of one piece construction and are mounted in bearing cages which also support the differential assembly. The bull gear hubs are spline mounted on the rear axle shafts.

Rear axle carriers and housings are of similar construction. Some change in form is made because of variations in drawbars and fenders. Two ball bearings are mounted in the housings which carry the axle shafts. Each housing is secured to the main frame with seven 5/8 inch cap screws and lock washers.

Rear axle shafts in the Farmalls M and MD extend beyond the width of the wheel hubs to permit adjustment of wheel tread for row crop tillage. The outer ends of these shafts have two key ways which engage the cast keys in the wheel hub and clamp. Other tractors in this group have fixed wheel mountings on the axles. The outer ends of these shafts are splined and the wheels are retained with large retainer washers, and 3/4 inch cap screws and lock washers.

Removal and Replacement

Removal and replacement of the bull pinion and cage assemblies are covered under "DIFFERENTIAL AND DRIVE BEVEL GEARS" on page 83. With the assemblies removed, the bull pinion is driven out of the cage by tapping lightly on the outer end of the shaft with a babbitt hammer. Inspect the bearings and the double leather seal. This seal is installed with the lips facing



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Illust. 97A--Transmission and final drive assembly "6" series wheel tractors.

the center of the tractor. The brake drum hub which makes contact with the seal must be smooth. A rubber seal ring in the groove on the outside diameter of the cage prevents oil leakage between the cage and main frame. Use a new rubber ring when assembling the cage.

Removal and replacement of the rear axle and carrier assembly are covered under "DIFFERENTIAL AND DRIVE BEVEL GEARS" on page 83 as the bull gears must be removed before the bull pinions or differential.

With the assemblies removed from the main frame, the axle shaft may be removed from the carrier by first taking off the outer bearing retainer. Press the shaft out by applying pressure to the inside end of the shaft. This leaves the inner bearing in the carrier. The outer bearing comes out with the shaft. The inner ball bearing is held in place by a retainer and four 1/2 inch cap screws in the Farmall carriers only, as this bearing takes the axle thrust on these models.

Remove, clean and inspect the bearings as outlined on page 79. Seals in the outer bearing retainer consist of a felt seal and a leather seal. The felt is installed toward the outside with the leather seal next to the bearing. The lip of the leather seal faces the ball bearing in all models. This seal makes contact with the axle on the Farmall models and makes contact with a spacer between the bearing and the wheel hub on the remaining models. Early spacers 60629D had a 3/8 inch long taper which made it necessary to install a leather seal with the lip facing the wheel. Later spacers 60629DA have a 1/16 inch radius on leading edge and are used when installing leather seal with lip facing ball bearing. When placing spacer on the axle shaft, be sure its drive pin is in place and a new seal ring 60631D is used between spacer and ball bearing. Use new gaskets when assembling the outer bearing retainers and between the carriers and the main frame. Be sure that gasket surfaces are clean and smooth to insure an oil tight seal.

FARMALLS MV AND MDV

Description

These Farmalls have a ground to rear axle carrier clearance of approximately 36 inches as compared to 23 to 25 inches on the Farmalls M and MD.

The rear main frame, bull pinion and bull gear set-up is identical with the M and MD. A sprocket and chain final drive is added to the outer end of the axle carrier. These housings enclose a 17 tooth sprocket, driving an 18 tooth sprocket on 10-27/32 inch centers. The chain is the double width, steel roller type. Each housing holds approximately 7 pints of lubricant. A cross sectional drawing of this drive is shown in illust. 99A.

The top or sprocket shaft is driven from the bull gear in the same manner as the axle on the M and MD. A leather oil seal is mounted at the outer end of the carrier which seals the final drive housing from the main frame. The lower or axle shaft is mounted on a single row and a double row ball bearing. The latter taking the axle thrust. A felt and leather seal is assembled in the outer bearing cap. The lip of this seal faces the bearing and makes contact with the axle shaft. The wheel is mounted on the axle with the convex side out as shown in illust. 99A. Tread adjustments are made by shifting the rim position only.

Removal and Replacement

The removal and replacement of the carrier and final drive assembly is accomplished in the same manner as the carrier and axle assembly on M and MD.

Disassemble the final drive as follows:

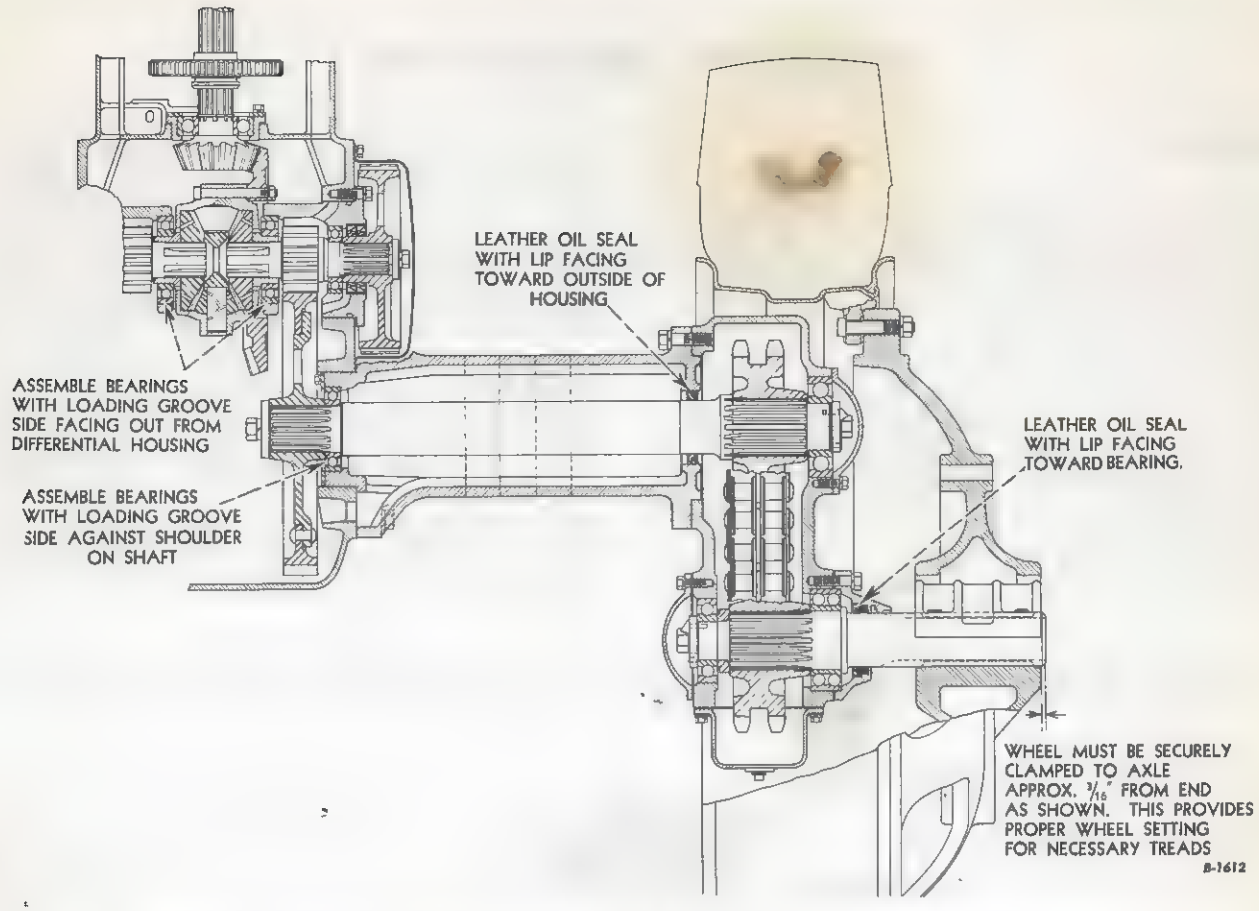
1. Drain the lubricant and clean the outside of the housing.

2. Remove the housing pan and double width chain connecting link.

3. Turn the chain out of the bottom of the housing.

4. Remove the inner and outer axle bearing caps.

5. Spread and remove the inner bearing retainer and cap screw.



Illust. 99A--Cross section of Farmall MV and MDV final drive and axle assembly, right hand side.

6. The axle may now be slipped out of the housing. Notice the spacer between the inner bearing and the lower sprocket hub. Upon assembly be sure that this spacer is properly placed with the wide face next to the sprocket hub.

7. Remove the sprocket shaft bearing cap.

8. Spread the lock and remove the bearing retainer cap screw.

9. Take out the cap screws which secure the final drive housing to the carrier.

10. Remove the carrier from the housing.

11. Remove the sprocket shaft.

12. Carefully clean and inspect the bearings. Protect them from dirt until ready for assembly.

Assemble in reverse order using new gaskets and oil seals. The sprocket shaft oil seal is assembled with the lip facing the sprocket. The axle shaft oil seal is assembled with the lip facing the bearing.

SPROCKET DRIVE AND TRACK FRAME PIVOT SHAFT

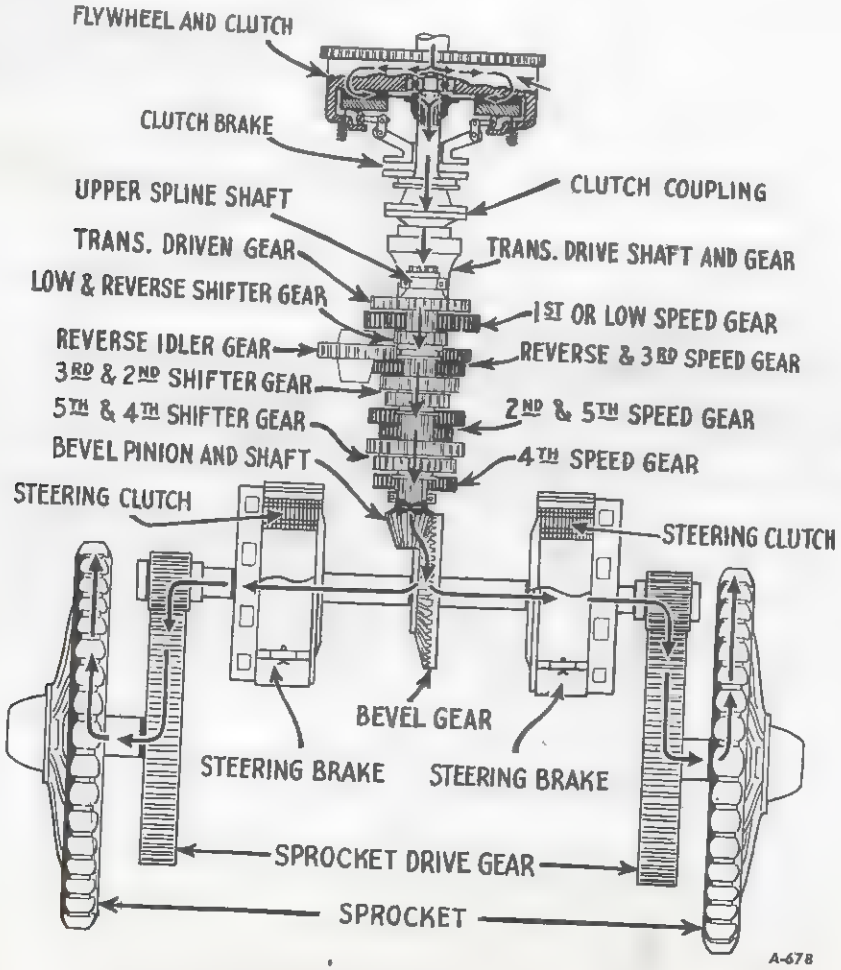
CRAWLER TRACTORS T-6 AND TD-6

Description

The line of power from the engine through the transmission, drive bevel gears and steering clutches is carried to the track chains by the sprocket drive. This consists of a ball bearing mounted pinion and a sprocket drive gear. The track chain sprocket, mounted on the stationary pivot shaft, is directly connected with the sprocket drive gear illust. 100A. The sprocket drive gear housings and the outer sprocket bearings are sealed with dirt deflectors, and spring-loaded floating diaphragm seals. The sprocket drive gears may be reversed to utilize both sides of the gear teeth.

Early production models used 13 tooth pinions and 55 tooth sprocket drive gears having a tooth pressure angle of 20 degrees. Effective with serial numbers TBK-8541 standard tread and TBK-8547 wide tread, 12 tooth pinions and 51 tooth drive sprocket gears were used having a tooth pressure angle of 22 degrees. Gears of different tooth pressure angles cannot be used together. The new type pinion and gears are marked "22 degrees" for identification. Track chain drive sprockets are heat treated steel castings having 25 teeth of 6.016 chordal pitch. The weight of the crawler tractor is carried on the track frame and rollers and little if any weight is carried on the sprockets. The sprockets are reversible; both sides of the teeth may be utilized.

The track frame pivot shaft extends through the rear frame from track to



Illust. 100A--Crawler tractor line of power from engine to track.

track. The driving sprockets and their drive gears revolve about this stationary axle. Track frames are mounted on the pivot shafts through a ball and socket joint, thus eliminating any twisting or leverage loads at this point. Heavy steel diagonal braces, attached to the track frames, are also pivoted at the mid-point of this shaft (illust. 101A).

Removal and Replacement

The complete sprocket drive can be removed without disturbing the steering clutch. Sprocket drive removal from wide tread crawler tractors is covered completely in the service chart (illust. 102A).

The disassembly procedure for narrow tread (refer to service chart illust. 103A) is as follows:

1. Take off the track chain.

2. Jack up the crawler tractor and remove the track frame.

3. Remove the track frame pivot bearing, outer dirt deflectors and oil seal.

4. Pull the bearing cage and bearing from the pivot shaft.

5. Remove the nut from the sprocket drive gear hub with wrench SE 1184-1 and pry off the sprocket.

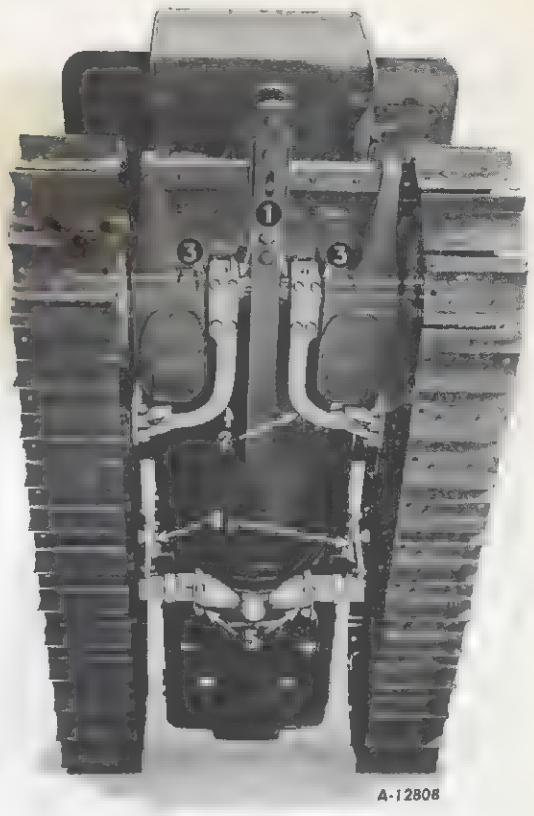
6. Remove the inner dirt deflectors, oil seal and loose spacer.

7. Remove the pinion shaft bearing cap and the bearing retainer.

8. Take off the outer sprocket drive gear housing.

The pinion and gear are now exposed. If the pinion or inner housing is to be removed, lock the steering brakes and support the steering clutch (the outer end of the steering clutch is carried by the inner sprocket drive gear housing). After removing the pinion and sprocket drive gear, the inner housing is removed.

Narrow tread assembly is in reverse order of disassembly. Be sure that all oil seals and gaskets are in good condition and that the oil seal nibs on the inside face of the inner seal engage the holes in the outer gear housing. The outer seal also has nibs which must engage the holes in the pivot bracket. The pinion shaft oil seal prevents oil leakage into the steering clutch compartment. The lip of this seal faces the bearing. The felt washer is assembled first in the bearing retainer. Replace the rubber ring between the main frame and the inner



Illust. 101A--Track stabilizer construction.

(1) track frame pivot shaft.
(2) diagonal brace.
(3) pivot bearings.
(4) stabilizer roller guide.
(5) equalizer springs.

housing if this housing is removed. This seal prevents leakage past the pivot shaft.

Remove the pivot shaft as follows:

1. Take off the drawbar.

2. Remove the cap screws from each diagonal brace at the pivot shaft.

3. Jack up crawler tractor at the rear end.

4. Remove the sprocket drive gears and housings down to the main frame.

5. Remove the diagonal brace bearings from the pivot shaft, drawbar braces, and pivot shaft locating set screws.

6. Clean all paint or rust from shaft.

7. The shaft is removed from the right or left hand side.

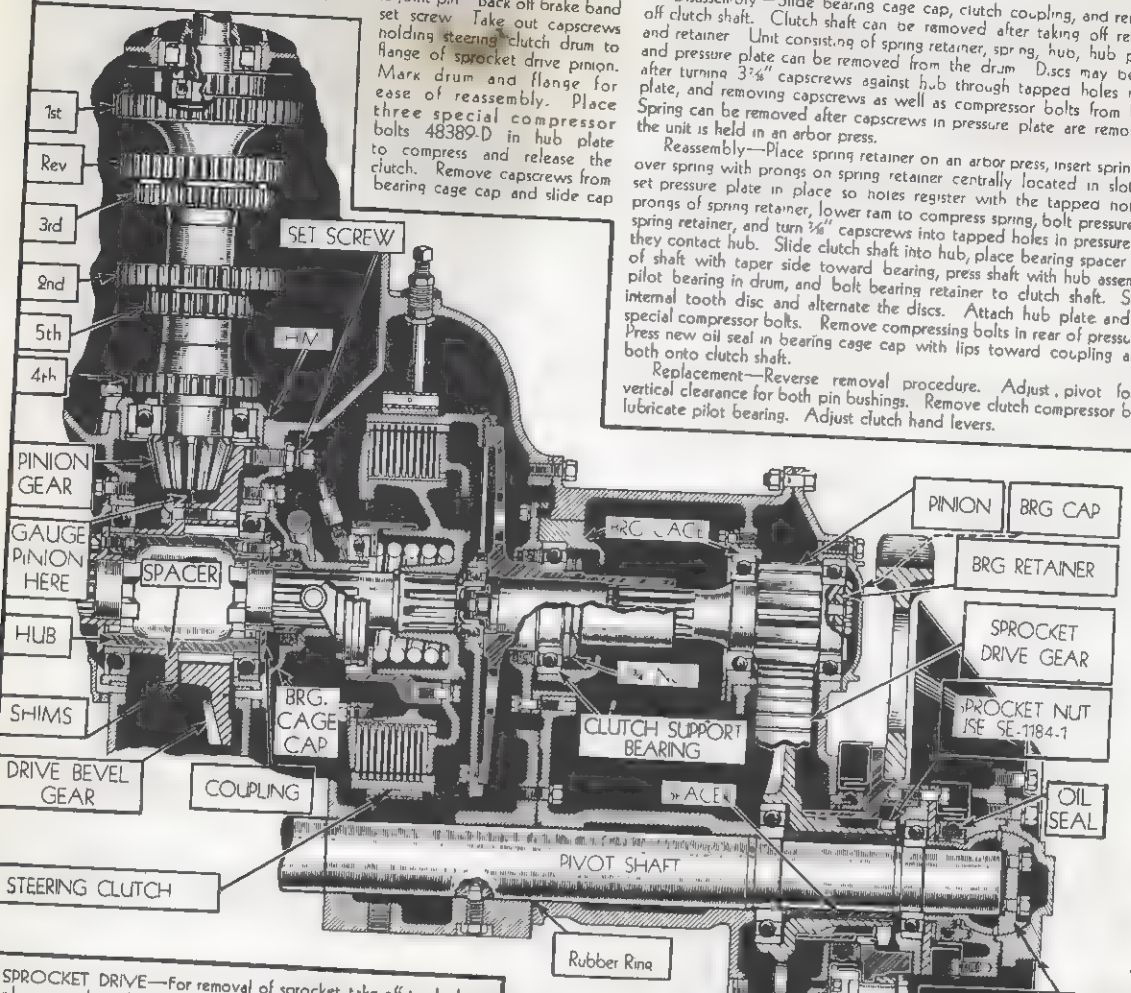
8. Be sure that new rubber rings are installed before replacing the inner gear housings.

STEERING CLUTCHES —Removal—Take off seat frame, fenders, fuel tank, battery, steering clutch controls, release fork shaft bearing, and main frame cover from top of main frame. Remove release fork pivot locks and lock nut and turn out pivot as far as possible. Take out release fork, release collar pin bushings, release collar lubricating tube, and upper brake joint pin. Back off brake band set screw. Take out capscrews holding steering clutch drum to flange of sprocket drive pinion. Mark drum and flange for ease of reassembly. Place three special compressor bolts 48389-D in hub plate to compress and release the clutch. Remove capscrews from bearing cage cap and slide cap back into steering clutch as far as possible. Remove bolts in clutch coupling. Put sling around clutch, pry coupling back into bearing cage cap, rock drum off flange, and lift unit from main frame.

Disassembly—Slide bearing cage cap, clutch coupling, and release collar off clutch shaft. Clutch shaft can be removed after taking off retainer bolt and retainer. Unit consisting of spring retainer, spring, hub, hub plate, discs and pressure plate can be removed from the drum. Discs may be removed after turning 3⅞" capscrews against hub through tapped holes in pressure plate, and removing capscrews as well as compressor bolts from hub plate. Spring can be removed after capscrews in pressure plate are removed while the unit is held in an arbor press.

Reassembly—Place spring retainer on an arbor press, insert spring, set hub over spring with prongs on spring retainer centrally located in slots in hub set pressure plate in place so holes register with the tapped holes in the prongs of spring retainer, lower ram to compress spring, bolt pressure plate to spring retainer, and turn ⅜" capscrews into tapped holes in pressure plate till they contact hub. Slide clutch shaft into hub, place bearing spacer over end of shaft with taper side toward bearing, press shaft with hub assembly into pilot bearing in drum, and bolt bearing retainer to clutch shaft. Start with internal tooth disc and alternate the discs. Attach hub plate and replace special compressor bolts. Remove compressing bolts in rear of pressure plate. Press new oil seal in bearing cage cap with lips toward coupling and slide both onto clutch shaft.

Replacement—Reverse removal procedure. Adjust pivot for equal vertical clearance for both pin bushings. Remove clutch compressor bolts and lubricate pilot bearing. Adjust clutch hand levers.



SPROCKET DRIVE—For removal of sprocket, take off track chain, place a jack under tractor on the side to be repaired, remove diagonal brace from pivot shaft on same side, remove track frame from pivot bearing, jack up tractor and remove sprocket shield and pivot bracket cap. Take off pivot bearing and pivot bracket with oil seal. Remove bearing retainer with dust seal and use ⅜" puller capscrews to remove sprocket bearing cage with bearing. Service tool SE-1184-1 may be used to turn off sprocket carrier nut. Sprocket can now be pried off hub of sprocket drive gear. Replacement is the reverse.

To remove sprocket drive gear, remove the sprocket as above, remove the pinion bearing cap, and the pinion bearing retainer. Use puller capscrews to remove outer gear housing. Sprocket drive gear can now be removed. Spocket drive pinion may be pried out if necessary. When replacing outer gear housing, have dowel pins in place before tightening bolts.

To remove inner gear housing, take out the steering clutches, turn flange of pinion shaft to make capscrews in pinion shaft bearing retainer accessible, and remove pinion shaft with bearing retainer, dust seal, oil seal, bearing, and bearing cage. Use puller capscrews to remove inner gear housing. Rubber pivot shaft oil seal ring between housing and main frame can now be replaced. Pinion can also be removed from the inner gear housing by removing capscrews in bearing cage. After pulling bearing cage from pinion shaft, the 3¾" nuts holding the bearing in place may be removed using wrench 9388-D with 11472-D. Reassembly is the reverse of the disassembly. Have dowel pins in place before tightening inner gear housing to the main frame.

BEVEL GEAR AND HUB—Removal—Take out steering clutches, bolts holding spacer to bevel gear, and back out deflection set screw. Use puller capscrews in right hand bearing cage to pull bearing cage with bearing from main frame. Use puller capscrews in left hand bearing cage to pull bearing cage from main frame. Slide hub and spacer out left side and lift bevel gear from its compartment.

Reassembly—Press the right hand bearing into right hand bearing cage. This bearing has an outer race narrower than its inner race. Flush side of bearing races is always to the right. Press right bearing cage and bearing onto bevel gear hub. Attach steering clutch coupling to right side of hub. Lower bevel gear into its compartment. Slide hub through bevel gear from right side and attach right bearing cage to main frame. Assemble right hand bearing cage cap to main frame. Slide spacer over hub from left side, assemble left bearing to left bearing cage and secure unit to hub and main frame. Be sure right side of bearing is the flush side of bearing races as shown. Attach left clutch coupling to hub and left bearing cage cap to main frame. Insert same number of shims between spacer and the bevel gear as were removed at time of disassembly, or insert shims to give .010 to .012" backlash with a new pinion gear.

When reassembling pinion gear, place .625" or specified gauge between ground surface on bevel gear and end of pinion. Then use proper number of shims between bevel pinion bearing cage and main frame to hold the gauge at this point when all bolts are tightened. Be sure backlash of bevel gear is .010 to .012" when pinion is held stationary. Now adjust deflection set screw on right side to have .020" clearance between it and back face of bevel gear. Replace steering clutch.

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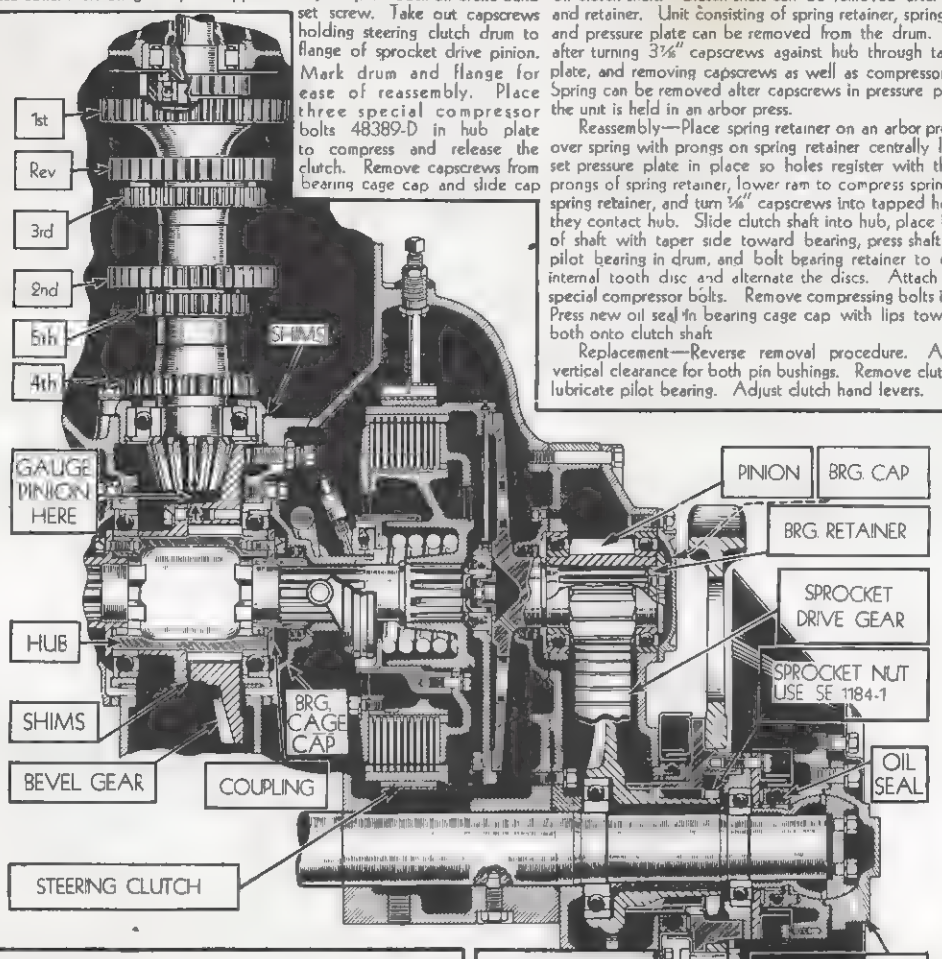
Illust. 102A—Final drive service chart, wide tread.

STEERING CLUTCHES—Removal—Take off seat frame, fenders, fuel tank, battery, steering clutch controls, release fork shaft bearing, and main frame cover from top of main frame. Remove release fork pivot locks and lock nut and turn out pivot as far as possible. Take out release fork, release collar pin bushings, release collar lubricating tube, and upper brake joint pin. Back off brake band set screw. Take out capscrews holding steering clutch drum to flange of sprocket drive pinion. Mark drum and flange for ease of reassembly. Place three special compressor bolts 48389-D in hub plate to compress and release the clutch. Remove capscrews from bearing cage cap and slide cap back into steering clutch as far as possible. Remove bolts in clutch coupling. Put sling around clutch, pry coupling back into bearing cage cap, rock drum off flange, and lift unit from main frame.

Disassembly—Slide bearing cage cap, clutch coupling, and release collar off clutch shaft. Clutch shaft can be removed after taking off retainer bolt and retainer. Unit consisting of spring retainer, spring, hub, hub plate, discs and pressure plate can be removed from the drum. Discs may be removed after turning 3⅞" capscrews against hub through tapped holes in pressure plate, and removing capscrews as well as compressor bolts from hub plate. Spring can be removed after capscrews in pressure plate are removed while the unit is held in an arbor press.

Reassembly—Place spring retainer on an arbor press, insert spring, set hub over spring with prongs on spring retainer centrally located in slots in hub, set pressure plate in place so holes register with the tapped holes in the prongs of spring retainer, lower ram to compress spring, bolt pressure plate to spring retainer, and turn ⅜" capscrews into tapped holes in pressure plate till they contact hub. Slide clutch shaft into hub, place bearing spacer over end of shaft with taper side toward bearing, press shaft with hub assembly into pilot bearing in drum, and bolt bearing retainer to clutch shaft. Start with internal tooth disc and alternate the discs. Attach hub plate and replace special compressor bolts. Remove compressing bolts in rear of pressure plate. Press new oil seal in bearing cage cap with lips toward coupling and slide both onto clutch shaft.

Replacement—Reverse removal procedure. Adjust pivot for equal vertical clearance for both pin bushings. Remove clutch compressor bolts and lubricate pilot bearing. Adjust clutch hand levers.



SPROCKET DRIVE—For removal of sprocket, take off track chain, place a jack under tractor on the side to be repaired, remove diagonal brace from pivot shaft on same side, remove track frame from pivot bearing, jack up tractor, and remove sprocket shield and pivot bracket cap. Take off pivot bearing and pivot bracket with oil seal. Remove bearing retainer with dust seal and use 7/16" puller capscrews to remove sprocket bearing cage with bearing. Service tool SE-1184-1 may be used to turn off sprocket carrier nut. Sprocket can now be pried off hub of sprocket drive gear. Replacement is the reverse. Be sure to engage nibs on inside face of inner oil seal with holes in outer gear housing as well as nibs on outer side of outer oil seal with holes in pivot bracket.

To remove sprocket drive gear, remove the sprocket as above, remove the pinion bearing cap, and the pinion bearing retainer. Use puller capscrews to remove outer gear housing. Sprocket drive gear can now be removed. Sprocket drive pinion may be pried out if necessary. When replacing outer gear housing, have dowel pins in place before tightening bolts.

To remove the inner gear housing, lock the steering brakes forward and support steering clutch through inspection opening in main frame cover. Remove sprocket and sprocket drive gear as outlined above. Take out bolts and use puller capscrews to pull inner gear housing with pinion bearing retainer, felt washer, oil seal, pinion bearing, and pinion. The rubber pivot shaft oil seal ring may now be replaced. When reassembling these parts, press bearing on pinion after replacing inner gear housing on main frame with dowel pins in place.

BEVEL GEAR AND HUB—Removal—Take out steering clutches, bolts holding spacer to bevel gear, and back out deflection set screw. Use puller capscrews in right hand bearing cage to pull bearing cage with bearing from main frame. Use puller capscrews in left hand bearing cage to pull bearing cage from main frame. Slide hub and spacer out left side and lift bevel gear from its compartment.

Reassembly—Press the right hand bearing into right hand bearing cage. This bearing has an outer race narrower than its inner race. Flush side of bearing races is always to the right. Press right bearing cage and bearing onto bevel gear hub. Attach steering clutch coupling to right side of hub. Lower bevel gear into its compartment. Slide hub through bevel gear from right side and attach right bearing cage to main frame. Assemble right hand bearing cage cap to main frame. Slide spacer over hub from left side, assemble left bearing to left bearing cage and secure unit to hub and main frame. Be sure right side of bearing is the flush side of bearing races as shown. Attach left clutch coupling to hub and left bearing cage cap to main frame. Insert same number of shims between spacer and the bevel gear as were removed at time of disassembly, or insert shims to give .010 to .012" backlash with a new pinion gear.

When reassembling pinion gear, place .625" or specified gauge between ground surface on bevel gear and end of pinion. Then use proper number of shims between bevel pinion bearing cage and main frame to hold the gauge at this point when all bolts are tightened. Be sure backlash of bevel gear is .010 to .012" when pinion is held stationary. Now adjust deflection set screw on right side to have .020" clearance between it and back face of bevel gear. Replace steering clutch.

B-394

Illust. 103A--Final drive service chart, narrow tread.

ELECTRICAL EQUIPMENT

DESCRIPTION

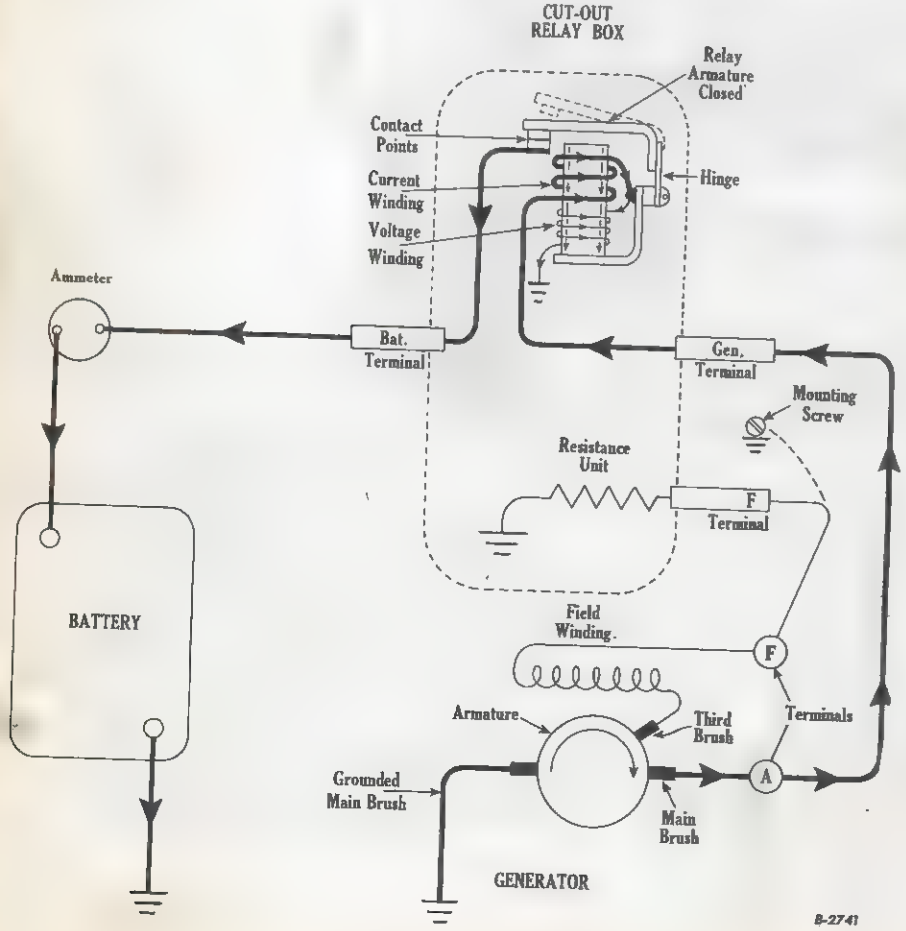
Electrical starting and lighting attachments available for the Farmall-M and "6" series line of tractors and power units greatly add to the usefulness and flexibility of their operation. The starter will save labor and fuel on jobs of short operating time which otherwise would call for idling during time out. The addition of electric lights extends the tractor working day to 24 hours when necessary during the rush season.

Attachments are available for lighting only, or starting only, as well as the complete starting and lighting attachment. A 6-volt system is used for the carbureted engines and for lighting only on those units using the Diesel engine. A 12-volt system is used for starting only and starting and lighting on the Diesel engine equipped units, as more power is required to crank the Diesel engine.

Like most automotive electrical systems, one side of the electrical circuit of each unit is connected to a common ground, which is the frame or metal parts of the tractor or power unit. The battery ground cable should be disconnected before working on any part of the electrical system where there is danger of contacting a live wire or terminal with the ground. Do not replace the battery ground cable until all other equipment has been connected. This procedure is good insurance against short circuits which may start fires or damage some of the electrical units.

A large percentage of all electrical equipment difficulties are caused by poor connections in the circuit. Connections should not only be mechanically tight, but contacting surfaces must be clean to insure a good electrical connection.

GENERATOR



The generator produces electricity by mechanical action, supplying current for lights and restoring to the battery the current used in cranking. The generator is of special design and dustproof construction to meet the demands of tractor operation.

A cut-out relay, also dustproof, is mounted on the generator. This relay is an automatic switch which connects the generator to the battery when the engine is operated and disconnects it as the engine stops, thereby preventing the battery from discharging through the generator windings when the generator is at rest (illust. 104A).

-Continued on page 106.

Illust. 104A--Schematic diagram of charging circuit. Relay armature closed by magnetic pull of voltage winding. Resistance unit in field circuit to limit charging rate to low range.

SPECIFICATIONS

GENERATOR, RELAY, AND LIGHTING SWITCH

FOR MODELS	Attachments	Volts	GENERATOR		CUT-OUT RELAY		LIGHTING SWITCH	
			IH No.	D-R No.	IH No.	D-R No.	IH No.	D-R No.
Farmalls M, MV, W-6, O-6, OS-6, I-6	Starting and lighting	6	45634 D	1101355	46412 D	1116766	57310 DY	1994019
U-6	Starting	6	58005 D	1101369	38600 D	5839		
T-6	St. & Lt.	6	47880 D	1101358	47885 D	1116807	57310 DY	1994019
Farmalls MD, MDV, WD-6, ODS-6, ID-6, TD-6	Lighting	6	47880 D	1101358	47885 D	1116807	57310 DY	1994019
UD-6	Starting	12	51602 D	1101726	59243 D	5884		
Farmalls MD, MDV, WD-6, ODS-6, ID-6, TD-6	Starting and lighting	12	51602 D	1101726	52297 D	1116808	57311 DY	1994020

GENERATORS

Gen. IH No.	Rotation	Volts	Field Current Amperes	Brush Spring Tension	Maximum Cold Output			Maximum Hot Output		
					Amperes	Volts	RPM	Amperes	Volts	RPM
45634 D	Clockwise	6	3.5 to 4.5	16 oz.	13 to 16	7.7 to 8.1	1800	9 to 11	7.3 to 7.6	1900
58005 D	Clockwise	6	3.5 to 4.5	16 oz.	13 to 16	7.7 to 8.1	1800	9 to 11	7.3 to 7.6	1900
47880 D	Clockwise	6	3.5 to 4.5	16 oz.	13 to 16	7.7 to 8.1	1800	9 to 11	7.3 to 7.6	1900
51602 D	Clockwise	12	1.5 to 1.67	16 oz.	8 to 10	14.4 to 14.9	2200	6 to 8	14.1 to 14.5	2400

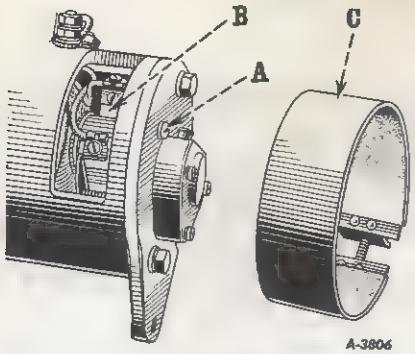
CUT-OUT RELAYS

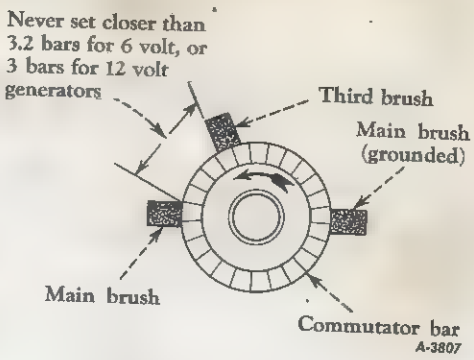
Cut-Out Relay IH No.	Volts	Air Gap with Points Closed	Point Opening	Armature Attracted To Core Volts	Armature Released from Core Amperes
46412 D	6	.020 inch	.020 inch	6.75 to 7.5	0.0 to 3.0 disc.
38600 D	6	.020 inch	.020 inch	6.3 to 6.9	0.0 to 3.0 disc.
47885 D	6	.025 inch	.016 inch	7.1 to 7.4	0.0 to 1.5 disc.
59243 D	12	.015 inch	.020 inch	13.0 to 14.2	0.0 to 4.0 disc.
52297 D	12	.015 inch	.020 inch	13.0 to 13.8	0.0 to 3.0 disc.

LIGHTING SWITCHES

Switch IH No.	Volts	Dimmer Coil Resistance		Generator Field Resistance*		Light Circuit Fuse	
		IH No.	Ohms	IH No.	Ohms	IH No.	Amperes
57310 DY	6	47889 D	5	47891 D	2.8	10815 VA	20
57311 DY	12	43039 D	2	43040 D	8.0	10815 VA	20

* Used also in relay box on generators of starting (only) attachments.



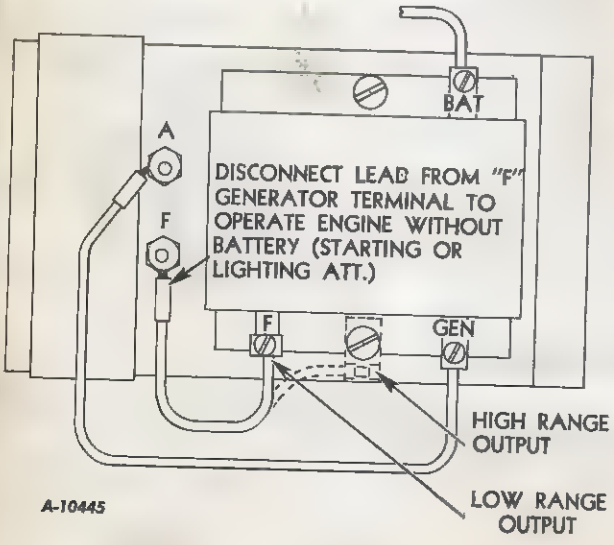


Illust. 106A--Location and limit of third brush adjustment. (A) third brush lock screw; (B) third brush; (C) generator cover band.

The generator output can be changed by shifting the position of the third brush in the generator or by operating the combination lighting switch and generator output control.

When the attachment does not include the lights and lighting switch, a fixed-generator field-resistance unit, enclosed in the cut-out relay box, is used to change the generator output. The high range output is obtained by securing the lead wire from the "F" field terminal of the generator under the relay box mounting screw, as shown by the dotted lines in illust. 106B. This permits the generator to produce full output as regulated by the position of the third brush.

If the battery is fully charged it is best to operate with the "F" terminal lead wire connected to the resistance terminal "F" on the box so that the generator produces a low range output. This low output is approximately 4 amperes on the 6-volt systems and 2.5 amperes on the 12-volt systems, with the generator hot. This charging rate is sufficient in normal operations to replace in the battery the current used in starting and also provide a small charging current to keep the battery in good condition, without danger of overcharging.



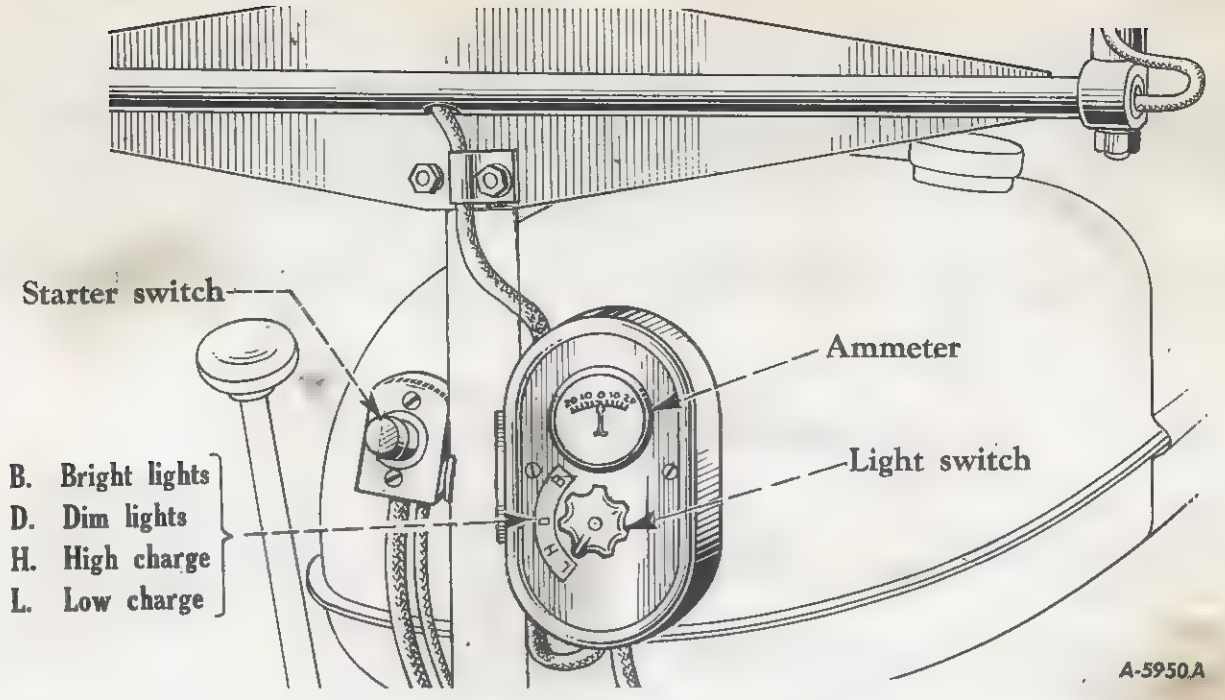
Illust. 106B--Drawing of external wiring of generator.

The combination lighting switch causes the generator output to increase when the lights are turned on, so that the generator can supply the extra current necessary for the lights. When the lights are turned off, the generator output is reduced to protect the battery against overcharge.

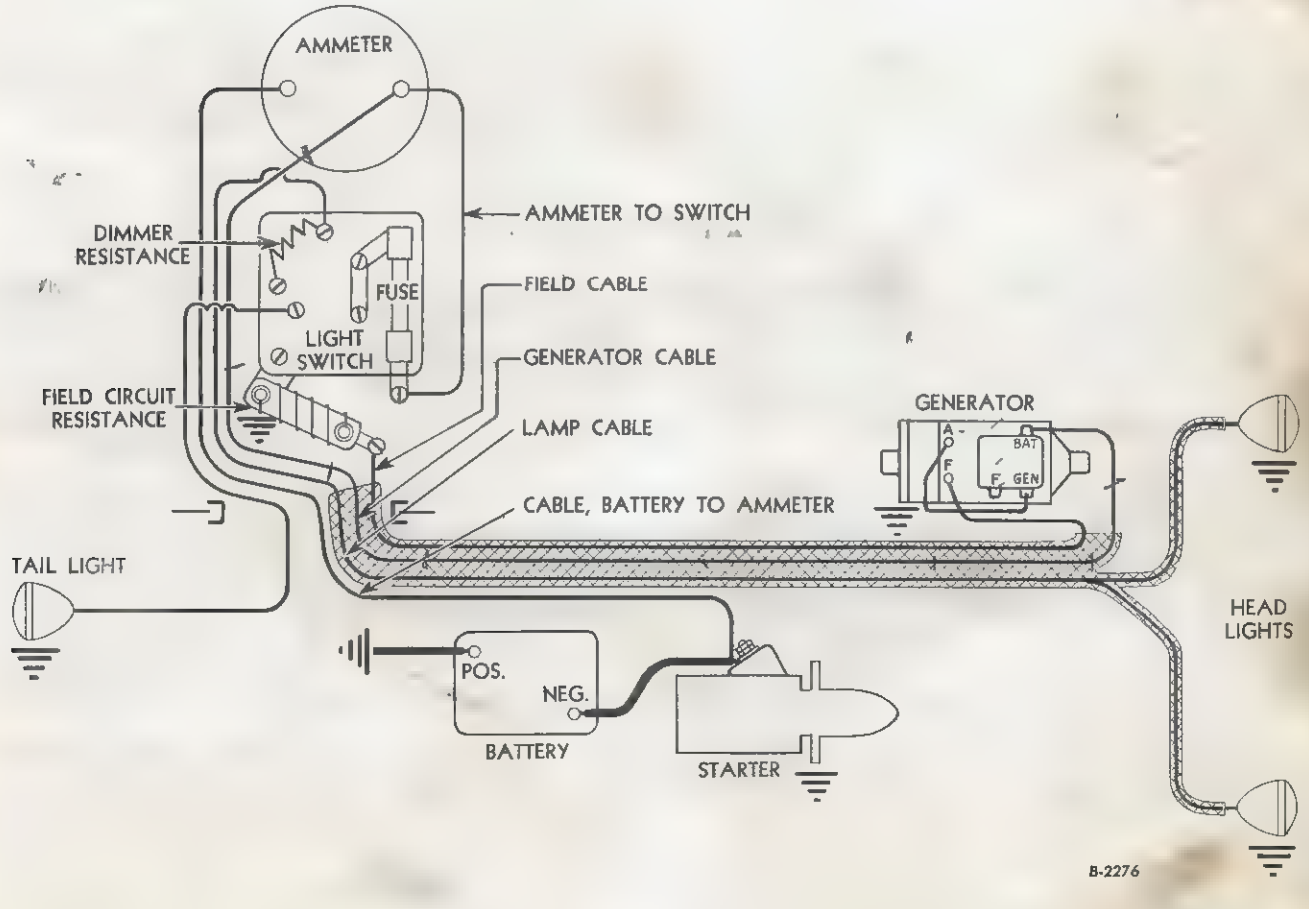
There is also an intermediate position "H" (illust. 107A) on the switch at which the lights are turned off, but leaving the generator at high output range. This switch position permits a high charging rate when the battery is being used for frequent engine cranking on short runs, or to recharge a run-down battery.

The generator control is obtained by a fixed resistance unit mounted on the switch which is connected between the "F" terminal of the generator and the ground when the lights are off (illust. 107B). The resistance being thus placed in the field circuit causes a weak generator field and a low generator output. When the lights are turned on or the switch is in the "H" position, the resistance is removed from the field circuit, permitting the generator to produce full output, as regulated by the position of the third brush.

As a rule the position of the generator third brush need not be changed since it is originally set to give the maximum safe output. This is 9 to 11 amperes for the 6-volt system and 6 to 8 amperes for the 12-volt system with the field resis-



Illust. 107A--Shows switch controlling lights and generator charging rate.



Illust. 107B--Starter and lighting system electrical circuit.

tance unit out of the circuit and the generator hot. A cold generator will show a higher output, but this will drop several amperes as the generator warms up. A larger output than the maximum given above and in the specification chart will cause the generator to overheat resulting in damage to its windings and soldered connections.

To operate the tractor or power unit without the battery it is necessary to disconnect the lead wire from the "F" terminal of the generator (illust. 106B); otherwise, removing the battery from the generator circuit would allow the generator to build up excessive voltage which would result in damage to the generator windings if the field circuit is not also opened. Another method of protecting the generator when operating without the battery is to remove the generator drive belt. This is the better method if the unit is to be operated over long periods of time without a battery.

GENERATOR OUTPUT FAILURE

Generator output failure may be caused by a number of conditions and the following check-up should be followed to disclose the difficulty:

1. Connect a wire temporarily between "F" field terminal of the generator and the generator frame with the engine running at medium speed. Be sure a clean electrical contact is made. If the output comes up, the generator is in normal condition, but the field circuit is not completed outside the generator. Check the lead wire from the "F" terminal of the generator to the resistance in the relay box (on starting attachments). On lighting, or starting and lighting attachments, check the "F" field circuit through the lighting switch. The metal frame of the lighting switch must make a good contact with the ground. Check the contact between the switch and instrument box cover and between the instrument box and its support. All contacts must be clean and free from rust. See also that the resistance unit is in good condition with no wires broken and connections clean and tight. Remove the temporary wire after the check is completed.

2. With the engine running at medium speed, use a short piece of wire connecting the "GEN" generator terminal of the relay with the "BAT" battery terminal of the relay leaving the wires found on these terminals also connected. If the generator output comes up, it indicates either the cut-out relay is at fault, or that the small amount of magnetism normally left in the generator was lost. If it is a case of deficient magnetism, the battery current restores it, and no further attention is needed. Remove the wire jumper used to connect the relay terminals. Stop the engine. Restart the engine and with relay cover removed, check the action of the relay. If defective, replace relay.

3. If the above checks fail to correct the difficulty, remove the generator cover band and inspect for thrown solder, commutator wear, roughness, or high mica. Inspect the brushes for wear and the spring arms for tension. The brushes should contact the commutator squarely and firmly, with 16 oz. brush spring tension.

4. Inspect the inside of the cover band. If small particles of solder are found thrown from the commutator, it indicates the generator has been overheated by too high an output, or by operating open-circuited from the battery. This condition requires a complete test of armature, and windings, and overhauling.

5. If the commutator looks black or dirty, use a strip of fine (No. 00) sandpaper, holding it against the commutator with a wood block while the generator is in operation. All dust from this operation must be blown out of the generator. NEVER use an emery coated paper or cloth to clean the commutator, as emery embeds in the soft copper and will wear down the brushes rapidly. It also has a tendency to short across the commutator bars.

6. If the commutator and brushes are gummed up with dirt and oil from excessive lubrication, it will prevent a good electrical contact of the brushes and the commutator will be found badly pitted. This condition calls for complete dismantling of the generator for thorough cleaning, and turning down the commutator.

7. In checking the connections between the generator and the lighting switch, and from the generator, cut-out relay, ammeter, and starter switch, to the battery and its ground, do not be satisfied with a tight connection alone; be sure the contact surfaces are also clean. A mechanically tight connection does not

necessarily indicate a good electrical connection.

8. Inspect the generator and fan belt for wear or glazing from slipping and bottoming in the pulley. Replace belts if necessary. Check bearings for roughness or wear by turning the pulley by hand and testing for excessive side play.

STARTING MOTOR

The electric starting motor cranks the engine when the circuit between the starting motor and the storage battery is completed by closing the starting switch. Engagement of the starting motor pinion with the flywheel gear is accomplished by the Bendix drive.

The pinion of the Bendix drive is mounted on a threaded sleeve so that when the armature of the starting motor revolves, the threaded sleeve turns within the pinion, moving it endwise to mesh with the gear on the engine flywheel. When the engine runs under its own power, the flywheel drives the Bendix pinion at a higher speed than the threaded sleeve, causing the pinion to be turned in the opposite direction on the threaded sleeve, thus the pinion is pulled out of mesh with the flywheel gear.

A large flat coil spring on the Bendix drive acts as a cushion when the pinion meshes the flywheel gear and also absorbs the shock of starting the flywheel rotation. The pinion is driven through this spring and requires the spring to be in good condition; the retaining screws must be tight and their locks in place. The threaded sleeve upon which the Bendix pinion is mounted must be kept free from heavy oil, grease and dirt so that the pinion may move freely on the spiral threads.

STARTING MOTOR FAILURE

Failure of the starting motor may be caused by a number of conditions, each of which can be located readily by making the following inspections:

1. Check the storage battery for the condition of the charge to determine if the battery can deliver sufficient current to crank the engine.

2. Inspect the battery cables for condition and be sure all connections are clean and tight to insure good electrical contacts.

3. With the battery ground cable removed, remove the starter switch and inspect for worn or burned contacts which would prevent the switch from closing the starter circuit.

4. Remove the starting motor cover band and inspect the commutator and brushes. Check the brush holders for free movement on their pivots. Check the spring tension (see specifications, page 110) to insure firm contact of the brushes on the commutator. Check the brush pigtail connections and brush retainer screws for tightness. Replace worn brushes.

5. If the commutator is black or dirty, clean with a strip of fine (No. 00) sandpaper while the unit is operated with the ignition off to prevent engine starting. Blow out all dust. Never use an emery coated paper or cloth to clean the commutator, as emery embeds in the soft copper and will cause rapid brush wear and shorting between the commutator segments. If the commutator is very dirty or burned, or has high mica, remove the starting motor and turn down the commutator; undercut the mica.

6. Thrown bits of solder found on the cover band indicate the starter has been overheated because of prolonged cranking periods or an abnormally stiff turning engine.

7. Inspect the Bendix drive for dirt or oily gum which would cause the pinion to mesh slowly or not at all on starting. The spiral threaded sleeve if lubricated at all, should have only a few drops of light oil.

8. Inspect the starting motor shaft for excessive side play indicating worn bearings, which would allow the armature to drag on the field poles. The armature may turn freely by hand but will drag when the starter switch is closed due to the pull of the magnetic field. Replace bushings if necessary. Check field poles

SPECIFICATIONS

STARTING MOTOR AND STARTING SWITCH

FOR MODELS	Volts	STARTING MOTOR		STARTING SWITCH	
		IH No.	D-R No.	IH No.	D-R No.
Farmalls M, MV	6	49344 D 63608 D	1107427 1107448	64931 H	405-C
W-6, O-6 OS-6, I-6	6	61270 D	1107444	64931 H	405-C
T-6	6	47870 D	1107435		1872405
U-6	6	60205 D	1107926	64931 H	405-C
Farmalls MD, MDV, WD-6, ODS-6, ID-6	12	61061 DA	1108913	64931 H	405-C
TD-6	12	47871 DB	779		1872405
UD-6	12	59242 DA	1108904	64931 H	405-C

STARTING MOTORS

Starting Motor IH No.	Rotation	Volts	Brush Spring Tension	No-Load Test			Lock Test			Bendix Drive Bendix No.
				Amps.	Volts	RPM	Amps.	Volts	Torque Ft.-Lb.	
49344 D	CC	6	26 oz.	65	5.0	6000	570	3.15	15	A-1660
63608 D	CC	6	26 oz.	65	5.0	6000	570	3.15	15	A-1660
61270 D	CC	6	26 oz.	65	5.0	6000	570	3.15	15	A-1660
47870 D	C	6	26 oz.	65	5.0	6000	570	3.15	15	A-1639
60205 D	C	6	26 oz.	60	5.0	6000	600	3.0	16	A-1639
61061 DA	CC	12	38 oz.	80	11.2	4500	670	5.35	32	A-2202
47871 DB	C	12	38 oz.	80	11.2	4500	670	5.35	32	A-2148
59242 DA	C	12	38 oz.	80	11.2	4500	670	5.35	32	A-2148

BATTERIES

FOR MODELS	Attachment	IH No.	Autolite No.	Batt. Used	Total Volts	Plates Per Cell	Capacity 20-Hr. Rate	Battery Dimensions		
								Long	Wide	High
Farmalls M, MV, W-6, O-6, OS-6, I-6, U-6	Starting and lighting, or starting only	61137 D	OC-15-AR	1	6	15	127 amp.	11-5/8	7-1/16	9-1/4
T-6	St. & Lt.	61138 D	OC-17-AR	1	6	17	145 amp.	13-1/16	7-1/16	9-1/4
Farmalls M, MV, W-6, O-6, OS-6, I-6 Farmalls MD, MDV, WD-6,ODS-6,ID-6	Lighting only	60909 D	Lb-1-13	1	6	13	88 amp.	9-1/16	7-1/16	8-5/8
T-6, TD-6	Lighting only	60910 DNS	OC-13-AR	1	6	13	127 amp.	10-5/16	7-1/32	9-1/4
Farmalls MD, MDV, WD-6, ODS-6, ID-6 TD-6, UD-6	Starting and Lighting	60910 DNS	OC-13-AR	2	12	13	127 amp.	Each Battery 10-5/16	7-1/32	9-1/4

for loose screws which would also allow the armature to drag on the poles.

When making the no-load or lock torque test of the starting motor on the test bench, refer to the specifications for normal amperage current draw. Values given are based on a good battery fully charged.

The flywheel ring gear is a shrink fit on the flywheel. When installing, heat the gear to approximately 500° F. Care should be taken not to exceed this temperature. Do not heat the gear with a welding torch or by direct flame. Uncontrolled heat will destroy the temper of the gear.

STORAGE BATTERY

The battery supplies electricity by chemical action. It furnishes electricity for lights and for cranking the engine in starting. For short periods of time the battery is able to supply current for loads far in excess of the output of the generator.

The battery has a second function, that of floating on the line, balancing or stabilizing the line voltage of the electrical system under normal operating conditions. If it were not for the battery, the voltage would rise and fall with the speed of the generator. If the battery cables become loose or corroded, thus forming a poor electrical connection, the generator voltage might rise to a point where the lamp filaments would be burned out, and the generator itself might fail because of overheating from the high voltage produced within its windings.

Water will be evaporated slowly from the electrolyte under normal operating temperatures of the battery. Rapid evaporation of water from the battery electrolyte indicates that the battery is being overcharged, thereby increasing the operating temperatures above normal. In addition to rapid evaporation of water, overcharging also causes excessive gassing. Bubbles of these gases rushing upward cause particles of active material to break away from the plate grids. This loss definitely shortens the life of the battery.

Neglect in keeping the battery electrolyte at the proper level will also shorten the battery life. A low electrolyte level will result in a higher concentration of acid, as only the water is evaporated from the solution. This strong acid chars the separators and shortens their life, and the partially exposed plate surfaces being inactive, become badly sulphated.

Undercharging or storage in a partially charged condition permits sulphate to form between the particles of active material. This slows down the action of the electrolyte on the plates and also sets up unequal strains within the plate. This tends to buckle the plates. A badly buckled plate may cut or wear through a separator, thus short-circuiting the cell and rendering the battery inoperative.

In testing the battery with a hydrometer, a variation in reading between cells of 15 points is not considered abnormal. If the variation exceeds this amount, the low reading cells may be considered defective. A hydrometer reading of the specific gravity of the electrolyte, to be accurate, must be taken with the liquid level of the cell at normal height, and the reading corrected according to the temperature of the electrolyte; the reading must not be taken immediately after water has been added to the electrolyte.

Voltage tests of each cell should be made under normal starting motor load. The individual cell voltages should not fall below 1.5 volts per cell at 60° F. or above, if the hydrometer reading is 1.225 or higher. The variation between cell voltages should not exceed two-tenths of a volt. A greater differential in voltage between cells indicates defective cells.

CHASSIS

FRAME

FARMALLS M, MV, MD AND MDV

The rear frame section, which contains the transmission, differential and final drive, is a one piece grey iron casting. The engine flywheel and clutch housing is also a one piece grey iron casting and is secured to the rear section with cap screws and dowels. The engine rear support plate and front frame channels are doweled and bolted to the clutch housing. The front engine supports are bolted to the two front frame channels which in turn bolt to the front axle bolster. Doweling and bolting together of all parts mentioned makes a rigid frame construction with permanent alignment of the units.

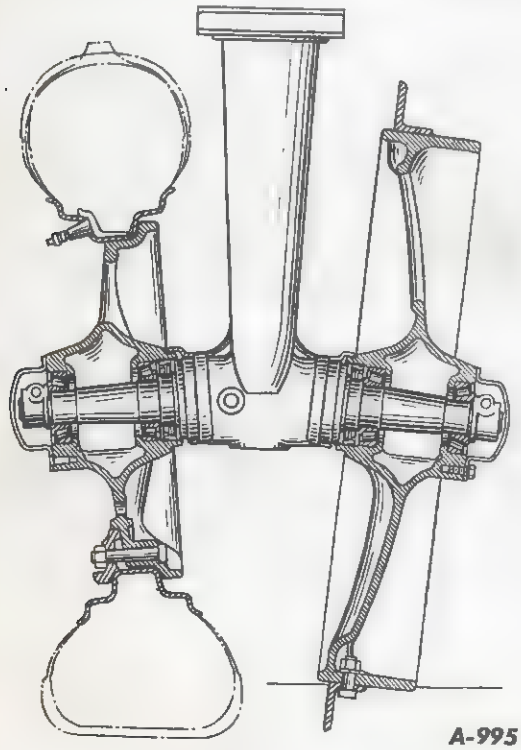
WHEEL TRACTORS W-6, WD-6, O-6, OS-6, ODS-6, I-6 AND ID-6

The rear frame section is very similar to the Farmall models. It also is a one piece grey iron casting which contains the transmission, differential and final drive. The front frame section too is a one piece casting which houses the flywheel and clutch and carries the front and rear engine support. The front and rear frame sections are doweled and bolted together for permanent alignment. The front frame cover gives access to the clutch and flywheel. The rear frame cover carries the steering gear and transmission shift assembly.

CRAWLER TRACTORS T-6 AND TD-6

The crawler tractor main frame is of heavy one piece construction. Separate sealed compartments within this frame enclose the flywheel and engine clutch, the transmission, bevel drive gears, and the steering clutches and brakes. The engine rear support plate and front frame channels which support the front of the engine are doweled and bolted to the main frame. The track frame pivot shaft and track frame equalizer spring are carried by the main frame casting. With this construction true alignment is assured. At the same time the different assemblies are accessible for adjustment or service.

FRONT AXLE AND FRONT WHEELS



Illust. 112A--Farmall lower bolster. Section through front wheels; one steel wheel and one pneumatic wheel shown.

FARMALLS M AND MD

The front axle and lower bolster pivot as a unit in steering. Four bolts attach the lower bolster to the upper pivot shaft upon which the front end weight of the tractor is carried. The pivot shaft turns in large diameter bronze bushings, the weight being carried on a heavy ball thrust bearing to assure ease in steering (illust. 112A).

Double steel wheels with a 2 inch skid ring are regular equipment. Wheel tread (center to center) is 9-1/8 inches. Pneumatic tire equipment is also available for 6.00 X 16 or 6.50 X 16 tires in both fixed and adjustable tread. The adjustable tread type wheels allow adjustment from 8 to 16-1/2 inches in 3 inch steps.

Single front wheels for use in crops having narrow spacings are also available. Steel or pneumatic tires may be furnished. The two sizes of pneumatic tires available are the 7.50 X 16 inch tire and the 9.00 X 10 inch tire. A fork type lower bolster is used with these wheels. Plain bearings in split hubs are

used in the single wheels. Each end of the hub is sealed with felt and leather seals and protected by dirt deflectors.

An adjustable wide tread front axle attachment is also available for use in potatoes and other crops where row spacings or bedding eliminates the use of single or double front wheels. With this attachment, front wheel treads are adjustable from 57 to 81 inches in 4 inch intervals. It has a wheel base adjustment for 90 and 100-1/2 inches.

FARMALLS MV AND MDV

The front axle of the high clearance Farmalls is a forged I-beam type center mounted by a pivot pin in the bolster. The axle is braced to the engine flywheel housing by a stay rod. Axle beam is high arched to give a maximum ground clearance of 30-1/2 inches. The forged steel steering knuckles have ball thrust bearings provided with a felt seal. The pivot of the steering knuckles rotates in steel backed bronze bushings. Tires are 6.00-20 inch pneumatic mounted on rims which are adjustable on the wheels to give treads of 60, 63 and 66 inches.

WHEEL TRACTORS W-6, WD-6, O-6, OS-6, ODS-6, I-6 AND ID-6

The front axles on these models are forged I-beam type, center mounted by a pivot pin in the bolster. They are braced by a stay rod to the front frame. The forged steel steering knuckles have ball thrust bearings provided with a felt seal. The steering knuckles rotate in steel backed bronze bushings. Bolsters are equipped with three-leaf bumper springs to limit the oscillation of the axle beam. Steering knuckle arms have stop screws for limiting the turning radius to prevent tire damage.

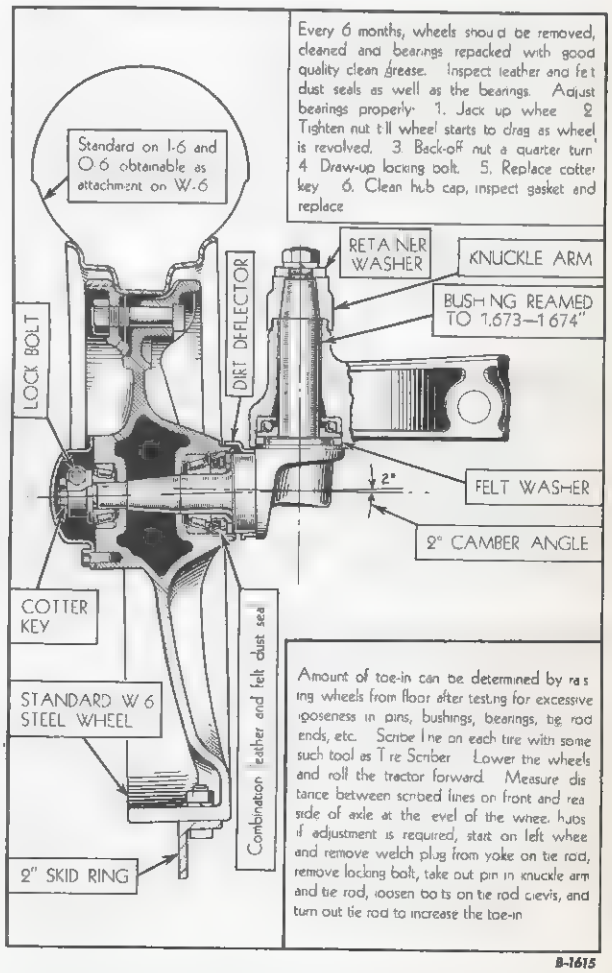
FRONT WHEEL BEARINGS AND SEALS, ALL MODELS

With the exception of the single front wheel attachment for Farmalls M and MD, all front wheels are mounted on tapered roller bearings. Dust shields and felt and leather seals mounted on the inner end of the axle spindles protect the bearings from entry of dirt or water. A replaceable steel sleeve in the wheel hub forms the surface contact for the felt and leather seal. The Owner's Instruction Manual calls for cleaning wheel bearings and repacking with fresh lubricant every six months. The seals are inspected at the same time and replaced if defective. Readjust the bearings by turning the wheel while tightening the retainer nut. When the wheel binds slightly back off the nut one castellation from the cotter pin hole. Replace the cotter pin and tighten the lock bolt in the retainer nut. Do not fill the wheel hub with grease. Work fresh grease into the roller retainers and repack bearings only. Use a good grade of chassis lubricant or wheel bearing lubricant.

TOE-IN ADJUSTMENT OF FRONT WHEELS

(See Illust. 113A)

Pneumatic Tires Rim Diameter Inches	Steel Wheels Rim Diameter Inches	Toe-In Inches
Up to 17	.....	1/8 to 1/4
17 to 24	22 to 26	1/4 to 3/8
24 to 35	26 to 30	3/8 to 1/2
.....	30 to 34	1/2 to 5/8



Illust. 113A--"6" series front wheel section.

STEERING GEAR

FARMALLS M, MV, MD AND MDV

The steering gear in these models is contained in the upper bolster. The steering worm gear sector (19 teeth) is mounted on the upper end of the bolster pivot shaft. The steering worm and shaft are mounted on a plain bushing and a single row ball bearing. The latter takes the worm shaft thrust. A leather seal is used to prevent leakage at the worm shaft. The bearing and worm shaft are retained by a large threaded plug. For cross-sectional views, see service charts in the center of this book.

WHEEL TRACTORS W-6, WD-6, O-6, OS-6, ODS-6, I-6 AND ID-6

The steering gear on these models is the worm and gear type. The housing is mounted on the rear frame cover and forms the support for the rear end of the fuel tank. The worm and shaft is mounted in plain bushings and a double row ball bearing. The latter takes the worm shaft thrust. The bearing and worm shaft are retained by a large threaded plug. The worm gear shaft is mounted on plain bushings. The drag link extends from the worm gear shaft arm on the left side of the tractor to the left steering knuckle arm. Removal of the retaining plug and worm shaft is made after the housing is removed from the tractor. Refer to service charts in the center of this book.

REAR WHEELS

FARMALLS M AND MD

A wide variety of steel wheel equipment is available for use in different types and conditions of soil and crops. These fabricated steel wheels range from the 2 inch channel rim to the 12 inch wide face type rim. All are in 51 inch diameters. Spade lugs for the various wheels are 4, 5 and 6 inch heights. A 2-1/2 inch spud lug is available for meadow work. Regular equipment is the 51 x 8-wheel with 4 x 2-1/2 spade lugs. Extension rims and road rings are also available.

A heavy cast wheel with provisions for the addition of wheel weights is used for all sizes with pneumatic tire equipment. The variation is in the detachable rim types and sizes. Rear wheel tread can be adjusted from 52 to 88 inches by moving the wheels in or out on the axles and by reversing the wheels on the axles.

FARMALLS MV AND MDV

These Farmalls are normally mounted on pneumatic tires, size 10.00 X 36 with a high profile tread. The same basic wheel is used as specified for Model M or MD. Wheels are mounted with the convex side out. Tread adjustment is made by shifting the position of the rim on the wheel. Three tread widths (60, 63 and 66 inches) are obtainable in this manner.

All Farmall wheels, both steel and pneumatic types, are secured to the axle by two keys cast as part of the hub and hub clamp. The hub clamp is tightened against the axle by four 3/4 inch cap screws. After a change of wheel position on the axle, the clamp cap screws should be retightened after a few hours work to insure seating of the clamp on the axle.

WHEEL TRACTORS W-6 AND WD-6

The rear wheels are fabricated steel type (42 x 10 or 42 x 12 inches) equipped with 4 x 2-1/2 inch spade lugs. Heavy cast wheels with provision for the addition of wheel weights are used with pneumatic tire equipment.

TRACTORS O-6, OS-6, ODS-6, I-6 AND ID-6

Heavy cast wheels for pneumatic tires are normally used on these models, The I-6 and ID-6 may also be equipped with dual pneumatics or solid type rubber tires.

Rear wheels on the W, O and I models are secured to the axle by a splined hub, a large retainer washer, and 3/4 inch cap screws. The inside of the hub rests against the bearing spacer. The bearing spacer forms the surface for the axle housing leather seal. A pin through the spacer into the axle spline assures the spacer turning with the axle. After the wheels have been replaced on the axle, the retainer cap screw should be retightened after a few hours work to insure seating the wheel hub, spacer and bearing on the axle.

CARE OF PNEUMATIC TIRES

The high inflation pressures used in tires during shipment of tractors must be reduced to normal operating pressures before the tractors are moved from the freight car. Refer to Owner's Manual for correct operating pressures. Operation of a tractor when tires are overinflated may result in serious damage to the casings even if driven only a short distance.

The tread bars on tractor tires wear evenly with correct air pressure and weight. Excessive slippage caused by insufficient wheel weight, overinflation, quick starting or too heavy draft loads result in irregular angular wear on the front or leading edges of the tread bars. Irregular and angular wear at the rear edges of the tread bars is caused by excessive wheel load or underinflation; or a combination of the two in highway or hard surface operation.

Frequent checking of the air pressure with an accurate gauge is the most important preventive maintenance operation. After mounting tire on the rim, overinflate it slightly to seat the tire bead against the rim flange. This prevents the tire from creeping and causing possible damage to the tube. Then, deflate the tire to the correct operating pressure. Be sure all rim clamps are assembled properly and clamp bolts are drawn up uniformly tight.

LIQUID WEIGHT

Tractor tire tubes can be filled with liquid to give the added rear wheel weight necessary to prevent excessive slippage under normal drawbar loads. Clean water may be used where the temperatures are above freezing (32° F.). In climates where lower temperatures are encountered a calcium chloride solution is recommended.

Various methods are used in filling tire tubes with liquid. They may be filled by gravity flow, by air pressure on the container, or with a force pump. Instructions for mixing the solution and filling the tubes have been issued by the various tire manufacturers and are available to all dealers.

CRAWLER TRACTOR TRACK AND TRACK FRAME ASSEMBLIES T-6 AND TD-6

TRACK FRAMES

The front idler, track idlers, and track rollers are attached to heavy welded steel channel-constructed track frames. Each track is free to oscillate vertically independent of the other. Each pivots from a ball and socket joint on the ends of the pivot shaft. This feature prevents leverage strains on the pivot shaft due to any slight lateral movement of the track frame. An equalizer spring, which carries the front end weight of tractor, makes contact with the track frame and roller type stabilizers maintain track spacing (the rollers are attached to the main frame side channels and the guides are attached to the top of the track frames). Heavy steel diagonal braces, bearing-mounted at the center of the pivot shaft, keep the track frame in an upright position, but allow vertical oscillation.

To remove track frames

1. Take off the track chain.
2. Jack up the tractor.
3. Take off the sprocket shield, pivot cap and bracket, front stabilizer roller guide, and bolts in the diagonal brace at the pivot shaft.

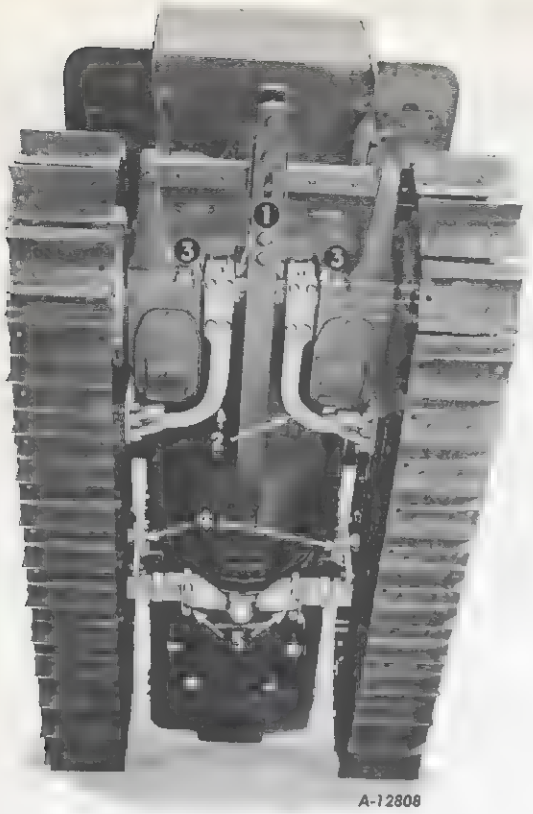
To assemble reverse the above procedure.

Illust. 116A shows the location of the diagonal braces, pivot shaft, ball and sockets and equalizer springs. To remove the equalizer spring it is not necessary to remove the track frame on one side.

The track stabilizer guide is of one piece construction on the T-6 and TD-6 crawler tractors as shown in illust. 116B.

EQUALIZER SPRINGS

Equalizer springs for the T-6 and TD-6 crawler tractors consist of four silicomanganese, pivot mounted leaves, designed to cushion the main frame from



Illust. 116A--Track stabilizer construction. (1) Track frame pivot. (2) Diagonal brace. (3) Pivot bearings. (4) Stabilizer roller guide. (5) Equalizer spring.

shock and strain. The ends of the spring ride on hardened pads inserted in the spring guides on the track frame.

Remove the equalizer springs from the T-6 and TD-6 crawler tractors as follows:

1. Jack up the front end of the tractor. Remove the crankcase oil pan guard (if the tractor is so equipped).

2. Remove the cap screws from the front end of the equalizer spring pivot shaft.

3. Remove the cap screws from the casting holding the pivot shaft and the drawbar pivot to the main frame.

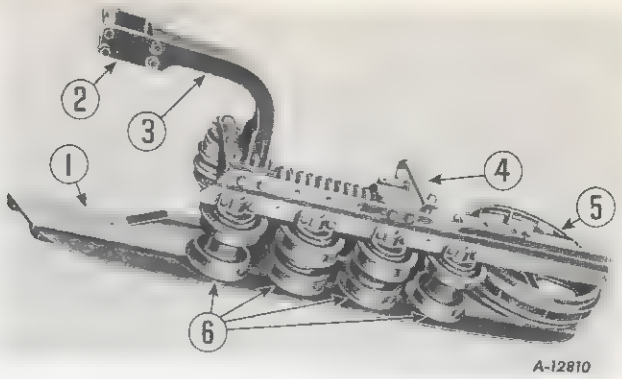
4. Push the pivot shaft and the drawbar as far to the rear as possible.

5. Slide the equalizer spring to one side so that the opposite side is free from the spring guide. Then pull forward to remove.

To replace, reverse the above procedure.

RIGID TRACK FRAME

A rigid track frame is used in place of the equalizer spring on crawler tractors equipped with cranes. On tractors equipped with a rigid track frame, the removal procedure is much the same as that where an equalizer spring is used. It must be moved forward to make the cap screws at the rear end of the oil pan accessible.



Illust. 116B--T-6 and TD-6 track frame. (1) Channel section. (2) Bearing location. (3) Diagonal brace. (4) Roller guide. (5) Front idler. (6) Track rollers.

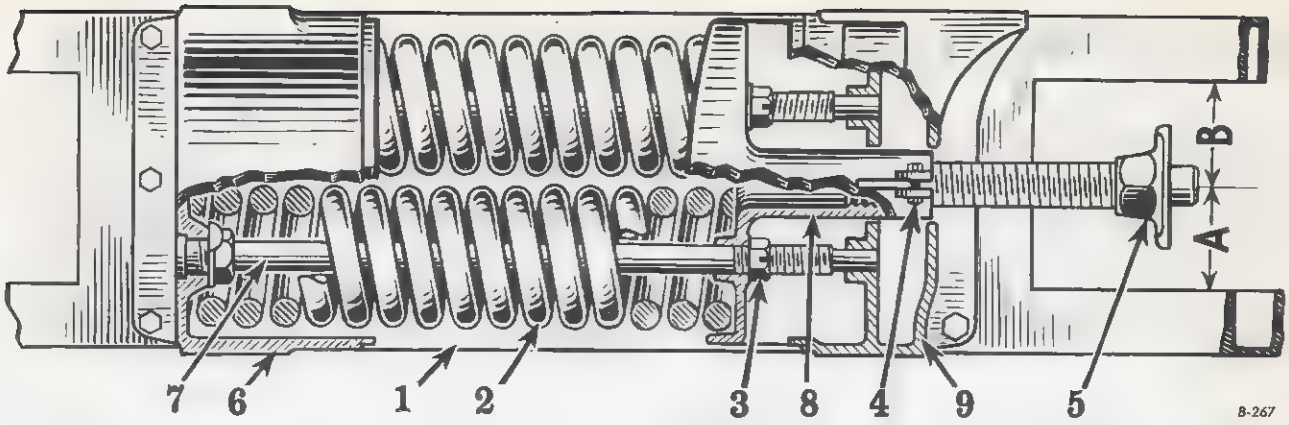
TRACK FRAME PIVOT

A heavy pivot shaft extends through the crawler tractor from track to track. The driving sprockets revolve on this stationary axle. Track frames are mounted on this same axle through a ball and socket joint, thus eliminating any twisting or leverage loads at this point. Heavy steel diagonal braces attached to track frames are pivoted at midpoint to this shaft.

To remove the pivot shaft, pull the pin from the front end of the drawbar. Remove the cap screws from each diagonal brace at the pivot shaft. Jack up the tractor at the rear end. Remove the sprocket drive gears and housings down to the main frame. Remove the diagonal brace bearings, the drawbar braces, the pivot shaft locating pins, and the paint from the pivot shaft. When replacing the pivot shaft be sure to install new rubber rings between the main frame and the carrier casting.

FRONT IDLERS

The front idlers are cast steel of the self-cleaning open type and are slide mounted to the track frames. Over all diameter of the idler is 21-1/4 inches for both the T-6 and TD-6 crawler tractors. Track tension is adjustable at the idler sliding mount. Two heavy coil springs, in a tension release mechanism, permit the idler to recoil under shock but exert no tension on the track in a normal operating position.



Illust. 117A--Track front idler and recoil spring. (1) Track frame; (2) recoil spring; (3) slotted nut; (4) locking bolt; (5) adjuster nut; (6) rear spring retainer; (7) spring adjusting rod; (8) front spring retainer; (9) equalizer and recoil spring guide.

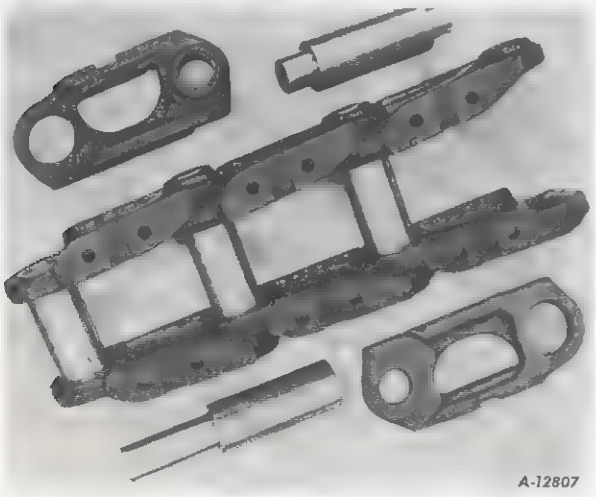
Illust. 117A shows the parts included in the recoil assembly and the point of track adjustment (5). Springs and adjusting rods (7) are locked in retainers (6) and fastened to the track frame (1) by cap screws. Springs (2) are held with the front retainer (8) and compressed by turning down the nut (3) until the cotter pin can be inserted in the hole in the rod. The dimensions "A" and "B" should be equal to prevent the front idler from cocking and thereby cause the tractor to creep. The front guide (9) pilots the adjusting rods for proper alignment. The bolt (4) is loosened before making adjustment of the front idler by turning the adjuster nut (5).

Maximum forward movement of the front idler is 3 inches on the T-6 and TD-6. When the limit of all front idler forward adjustments is reached the old track should be replaced with new track. Proper tension of the track is covered under the discussion on "Track Chain" page 118. With a new track chain, the maximum recoil movement of the front idler is 2-1/2 inches on T-6 and TD-6.

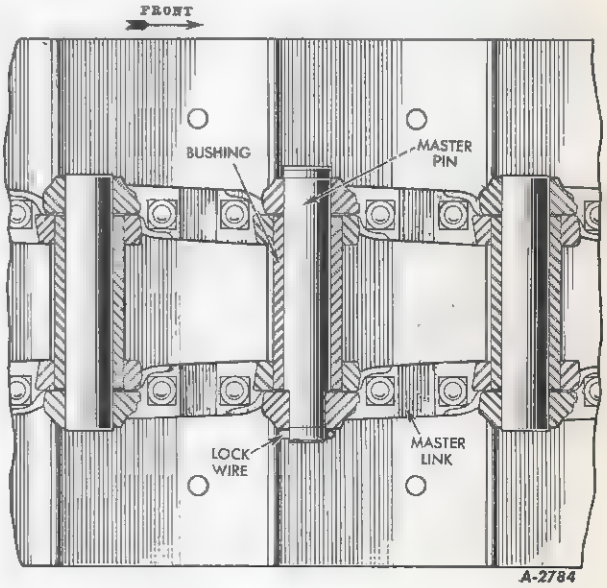
The idler carrier is equipped with bronze bushings which rotate on a heat treated steel shaft and are triple sealed with dirt deflectors, felt washers and spring loaded leather seals (lips turned outward). Repair bushings are furnished reamed to size.

TRACK CHAIN

Track links are drop forged and heat treated steel. Track pins and bushings of machined, carburized and hardened steel are forced into links under great pressure. The pins move freely in bushings but the ends are press fit into the track links. (The left and right hand tracks are



Illust. 117B--Track links, bushings and pins.



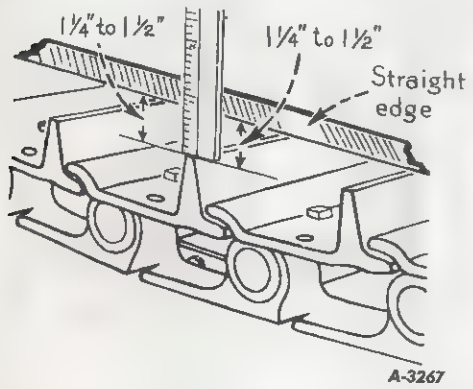
Illust. 117C--Track link master pin assembly.

interchangeable). A master pin (illust. 117C) is provided for easy track removal.

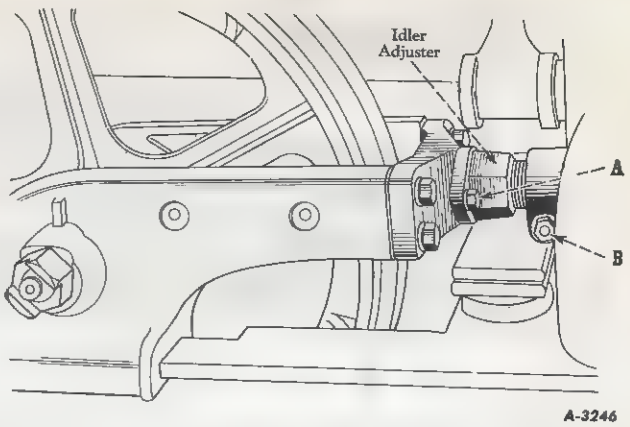
Check the tension after the track chain has been thoroughly broken in. The proper tension of the track determines its life. If the track chain is too loose it will tend to climb the sprocket. Whether too loose or too tight, either condition will cause undue wear on the track links, pins, bushings, bearings, and front idler bearings.

Correct adjustment of the track chain is accomplished by placing a wooden block approximately one foot in height under the foremost track shoe lug. With the engine running, put the tractor in low gear and engage the clutch just enough so that the sprocket drive tightens the chain along the ground and around the sprocket. After locking the brake and stopping the engine, stand on top of the track chain. This pulls the chain tight around the front idler, leaving all the slack in the top part of the track.

Place a straight edge along the top of the track lugs between the idlers. The clearance between the underside of the straight edge and the top of the center lug, as shown in illust. 118A, should be 1-1/4 to 1-1/2 inches for the T-6 and TD-6. If adjustment is necessary, remove the two cap screws "A" (illust. 118B) at the front of the track spring adjuster and the track spring adjuster lock bolt "B." Turn the adjuster clockwise (as viewed from the rear or sprocket end). This pushes the front idler yoke forward and tightens the track chain. Turn counterclockwise to loosen the track chain.



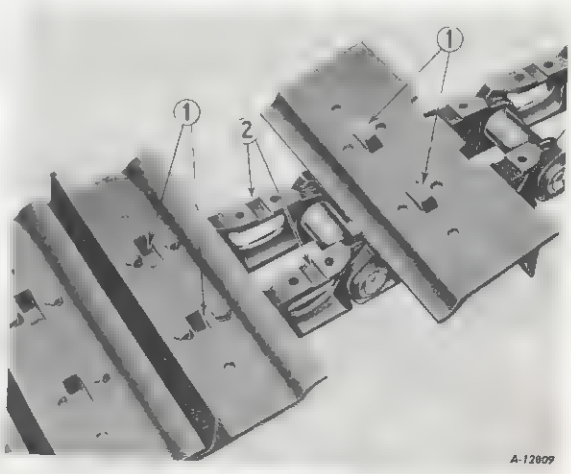
Illust. 118A--Check slack in track chain.



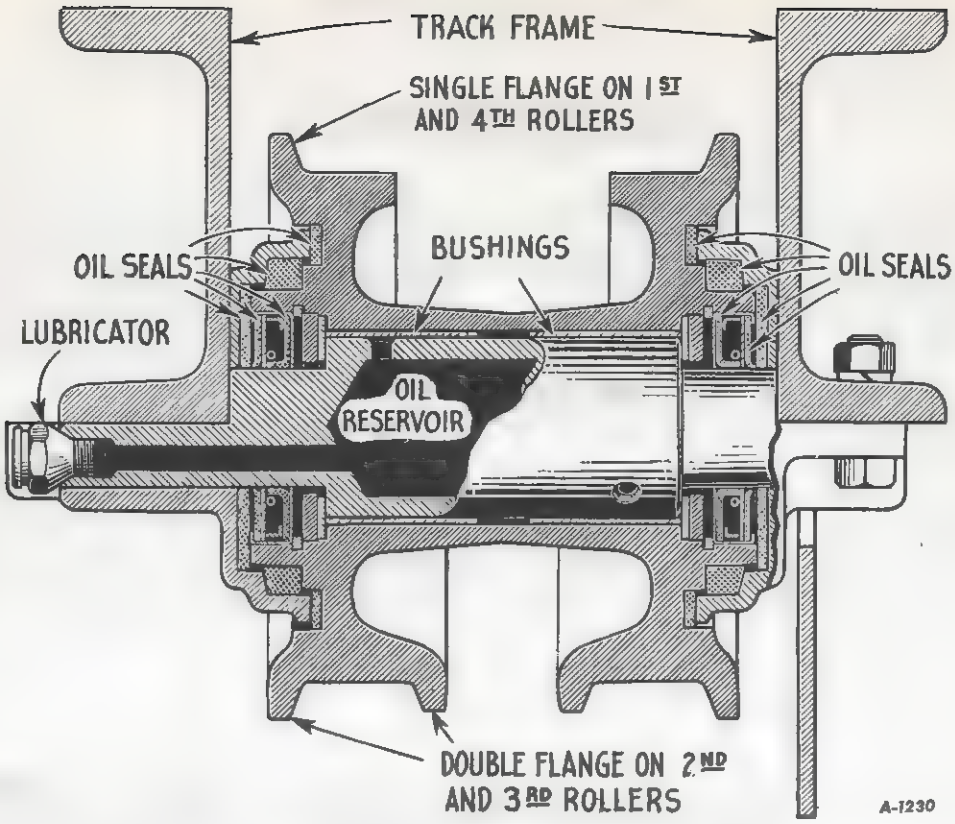
Illust. 118B--Adjusting track chain.

TRACK SHOES

Standard equipment includes heat treated rolled section, overlapping and keyed grouser type track shoes. Sixty-four 10 inch shoes are regular equipment. Eight and twelve inch width shoes are also available. For the wide tread crawler tractor only shoes of 14, 16, 18 and 20 inch widths are furnished. Various types of shoes and grousers are obtainable to meet all traction conditions. Shoes are keyed and fastened to track links by 4 (each shoe) heat treated alloy bolts. Illust. 118C shows the milled slots into which keys on the shoes fit which assures a permanent fastening. Two holes are provided in each shoe for the attachment of auxiliary shoes.



Illust. 118C--Track shoe and chain. (1) Keys on track shoes; (2) Slots in track links.



Illust. 119A--Track roller.

TRACK ROLLER

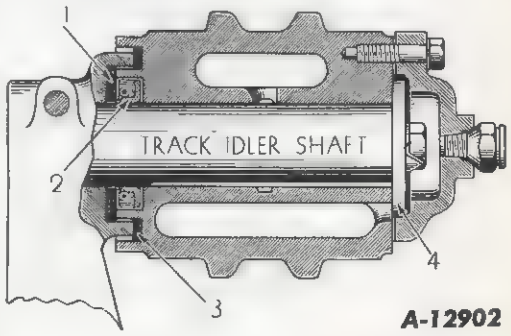
Four track rollers on each side carry the weight of the crawler tractor. The rollers are welded and heat treated steel forgings fitted with bronze bushings. They rotate on heat treated and hardened steel shafts. Repair bushings are furnished reamed to size. It is only necessary to press them into place.

To effectively seal out dirt, each end of the roller is fitted with three individual felt washers and a spring loaded double leather seal with lips turned out. The rollers are gravity lubricated from the oil well within the steel shaft.

Illust. 119A shows construction of the track rollers. The first and the fourth rollers have flanges on the outside only. The second and third rollers have double flanges to guide the track and relieve side thrust.

TRACK IDLER

The upper section of the track chain, between the sprocket and the front idler, is supported by one grey iron idler with chilled outer faces (increased hardness). It is mounted on a bracket extending upward from the track frame. This idler revolves on a heat treated replaceable steel shaft which is locked in the bracket with a bolt. A felt washer and spring loaded leather seal with the lip turned away from the idler provide a dustproof seal (illust. 119B).



Illust. 119B--T-6 and TD-6 track idler. (1) Inner felt washer. (2) Oil seal. (3) Outer felt washer. (4) Thrust washer.

ATTACHMENTS

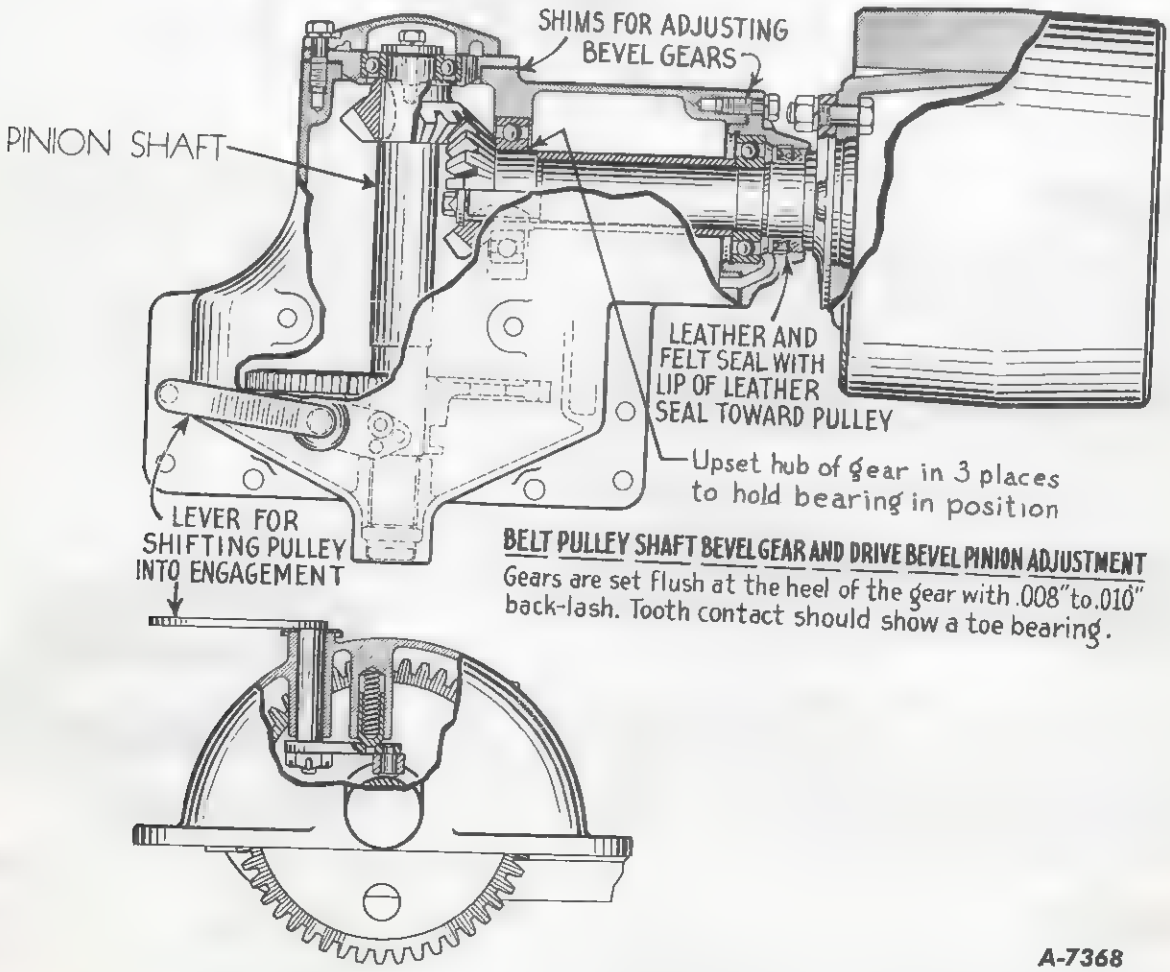
TRACTOR BELT PULLEY

Wheel type tractor belt pulley attachments mount on the transmission cover below the fuel supply tank. They are driven by a 39-tooth gear on the transmission drive shaft. Refer to illust. 120A for cross sectional view and adjustment of the bevel gears. The alignment of the pulley drive housing in relation to the transmission is secured by two dowel pins.

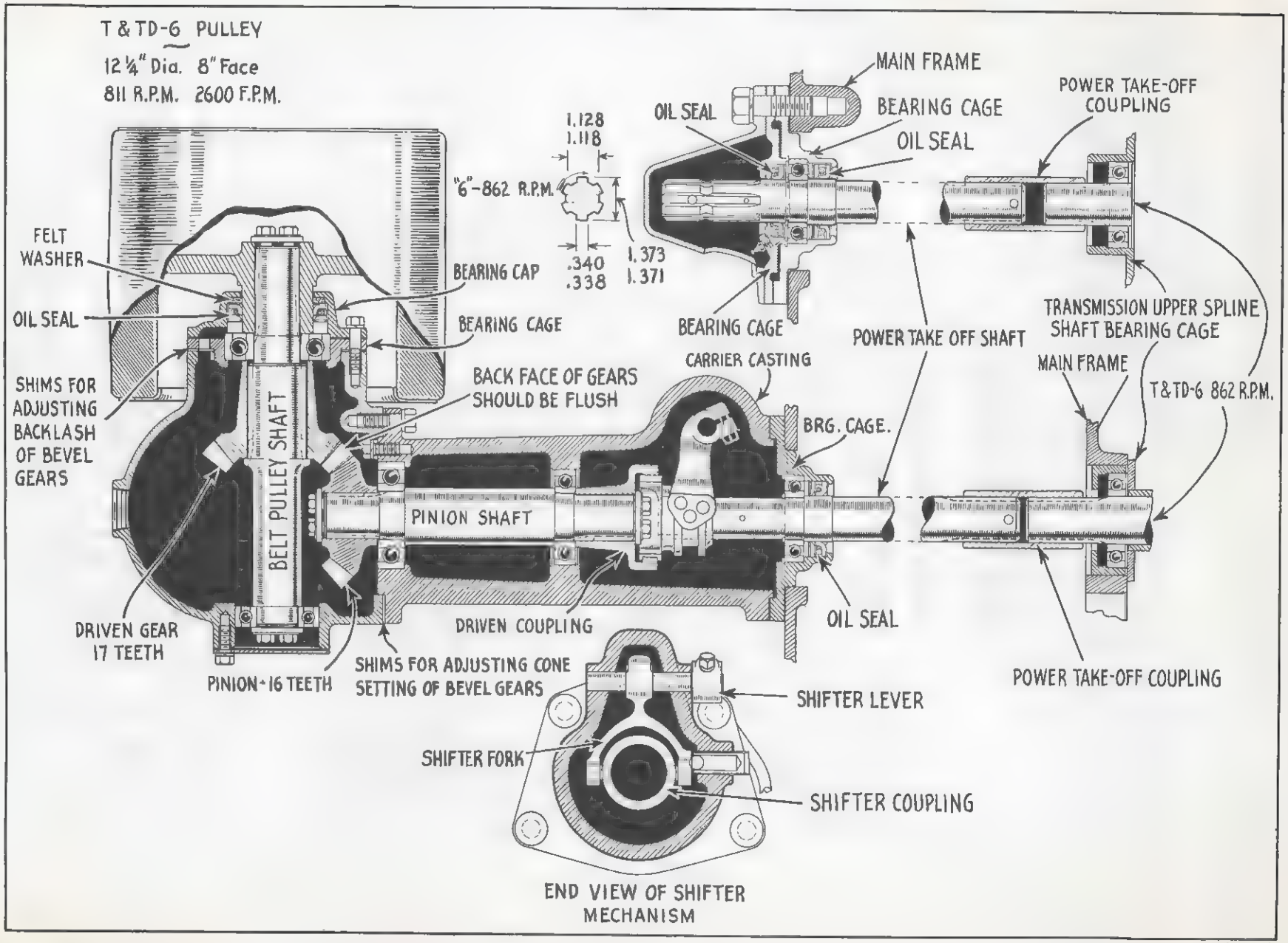
Belt pulley rpm is 899 at the rated load engine speed of 1450 rpm. Pulley sizes and belt speed in feet per minute are given in belt pulley data on page 122.

Crawler tractor belt pulley attachments mount at the rear of the main frame, over the power take-off shaft opening. They are driven by the power take-off shaft through a shifter coupling. Refer to illust. 121A for cross sectional view and method of adjusting the bevel gears.

The belt pulley may be mounted to the right or to the left-hand side of the tractor center line by shifting the pulley gear box on its carrier. Eight 7/16 inch cap screws in the carrier are removed and the gear box rotated 180°, which changes the position and direction of rotation of the belt pulley. When making



Illust. 120A--Belt pulley attachment, wheel type tractor.



Illust. 121A---Crawler tractor belt pulley and power take-off.

such a change-over, be sure to replace all the shims found between the gear box and carrier; otherwise, the gears will be out of adjustment. Also, exchange the locations of the breather and level plug in the gear housing.

The belt pulley turns at 811 rpm with the rated load engine speed of 1450 rpm. Pulley sizes and belt speed in feet per minute are given in belt pulley data below.

Power unit belt pulleys are furnished in a large variety of face widths and sizes to meet a wide range of drive requirements. Pulleys available on special order may be found below.

The extended pulley shaft and outboard bearing attachment 60612 D is recommended where a small diameter drive pulley is used and where high belt tension is indicated. Extra wide face pulleys are also designed for use with the extended pulley shaft attachment.

BELT PULLEY DATA

Crawler Tractors 811 RPM

Pulley	Face	Diameter	Belt Speed Ft. Per Min.
62313 D	8-1/2 in.	9-1/2 in.	2017
49558 DA	8-1/2 in.	11 in.	2335
53254 DA	8-1/2 in.	12-1/2 in.	2654
62314 D	8-1/2 in.	13-3/4 in.	2919
62315 D	8-1/2 in.	14-3/4 in.	3131

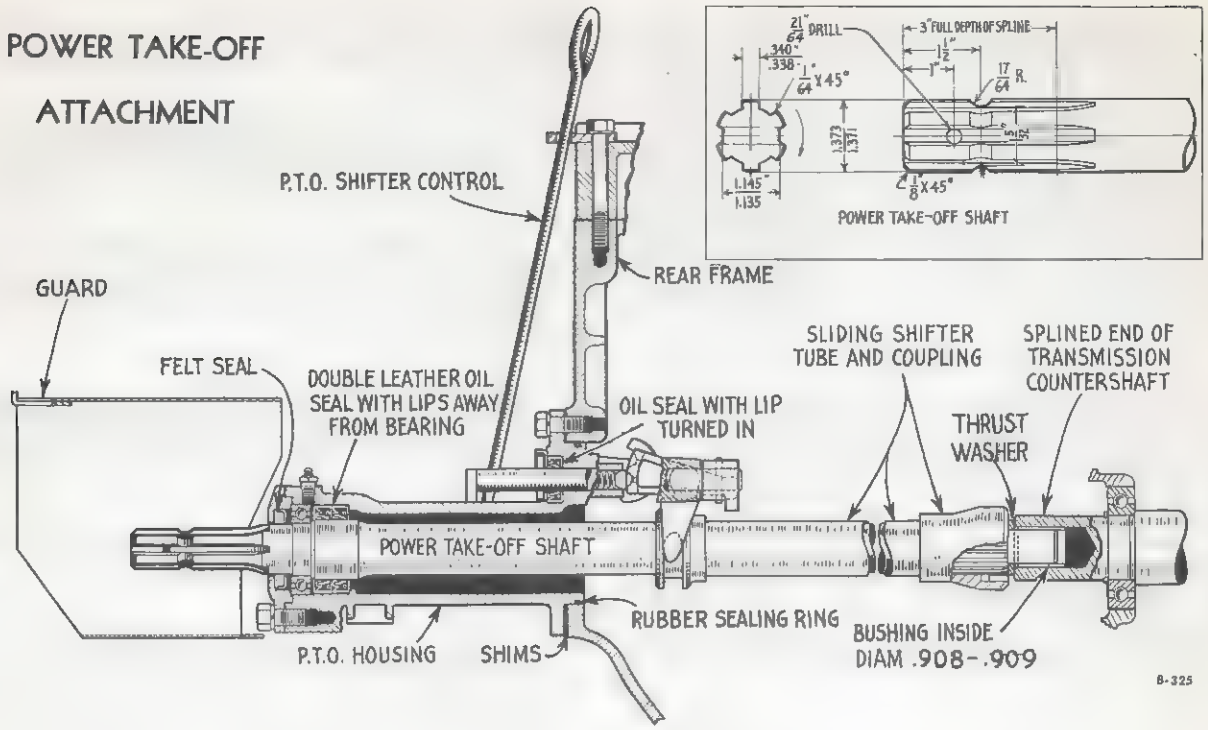
Wheel Tractors 899 RPM

Pulley	Face	Diameter	Belt Speed Ft. Per Min.
58518 D	8-1/2 in	6-1/2 in.	1531
58519 D	8-1/2 in.	7-1/2 in.	1765
58520 DA	8-1/2 in.	8-1/2 in.	2000
49131 D	8-1/2 in.	9-3/4 in.	2295
49248 D	7-1/2 in.	11 in.	2588
58522 DA	8-1/2 in.	11 in.	2588
58523 DA	8-1/2 in.	12 in.	2824
58524 DA	8-1/2 in.	13 in.	3060
59133 D	8-1/2 in.	14 in.	3295
58526 DA	8-1/2 in.	15 in.	3530

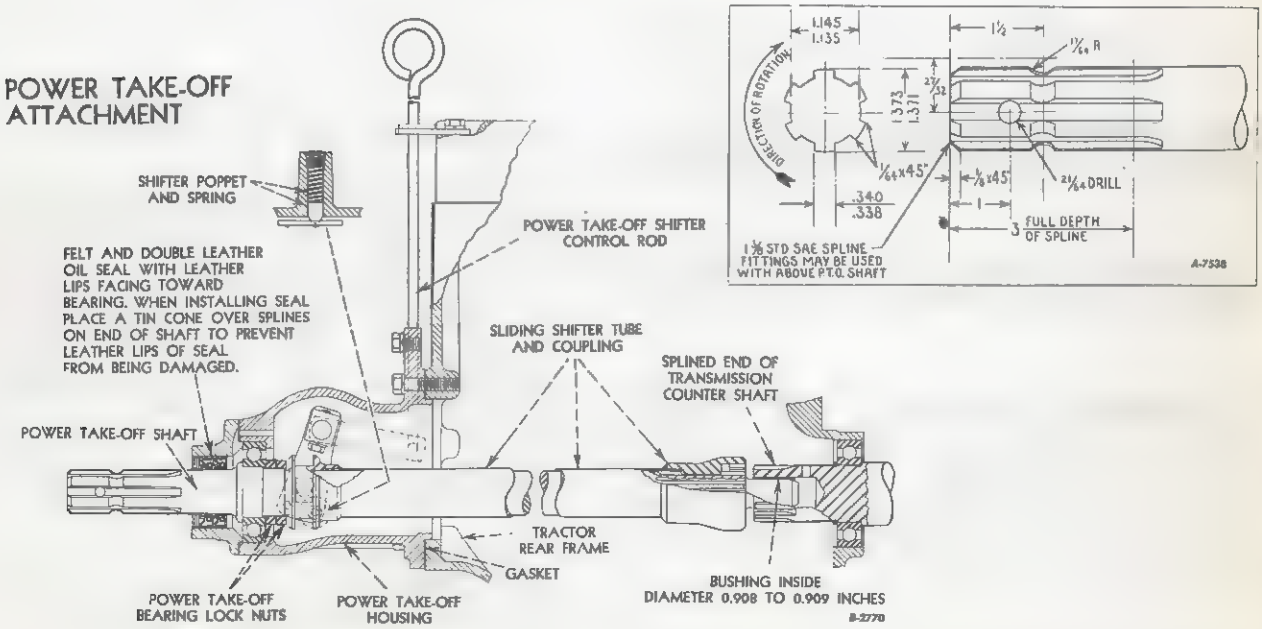
Power Units 1500 RPM

Face	Diameter
6 in.	15 in.
7-3/4 in.	8-1/2, 10 and 12 in.
8-3/4 in.	8-1/2, 9, 10, 12, 13, 14, 15, 17 and 18 in.
9-3/4 in.	8-1/2, 9, 10, 12, 15 and 16 in.
11 in.	*8 and 11 in.
12 in.	10, *12, *14 and 17 in.

* For use with extended pulley shaft and outboard bearing attachment.



Illust. 123A--Type of power take-off construction used on I-6 and ID-6 and early production of wheel tractors. Note shims used for adjustment of P.T.O. shaft end play.



Illust. 123B--Type of construction used on present production wheel tractors except I-6 and ID-6. Shaft thrust and end play taken on P.T.O. ball bearing.

POWER TAKE-OFF

Farmall and Wheel Tractor - Power take-off attachments are mounted in the rear center of the tractor main frame. They are driven from the splined end of the transmission countershaft through a shifter coupling. The power take-off clutch consists of an internal gear coupling which is shifted into engagement with the splines on the end of the transmission countershaft. The engine clutch must be disengaged while shifting the power take-off.

The front end of the power take-off shaft is supported in a bushing within the transmission countershaft. The rear end rotates in a ball bearing mounted in the power take-off housing. A felt and double leather seal with lips facing the bearing is used in the bearing retainer cap. Any standard SAE 1-3/8 inch spline fitting may be used to connect the attaching machine to the power take-off.

The I-6 and ID-6 industrial tractor power take-off turns at 641 rpm. All other tractors in this group have a power take-off speed of 537 rpm. These speeds are based on engine rated load speed of 1450 rpm.

Farmalls M and MD use the 66413 D power take-off attachment. However, early tractors below serial number 27997 with the notched end transmission countershaft must be equipped with the splined end countershaft 59354 DX or 60125 DX before the above attachment is installed.

Farmalls MV and MVD - Serial numbers 58712 and up use the power take-off attachment 6867 D.

W-6 and WD-6 Tractors - Serial numbers 501 to 1798 with the notched end transmission countershaft use 60192 DA power take-off attachment. Tractor serial numbers 1799 to 7034 with the splined end transmission countershaft use 60191 DA power take-off attachment.

Tractors serial numbers 7035 and up with the drawbar braced from the main frame cover and the splined end type transmission countershaft use 67232 D standardized power take-off attachment.

O-6, OS-6 and ODS-6 Tractors - Use the following power take-off attachments:

O-6 tractors, serial numbers 501 to 7027 with the notched end transmission countershaft use 60192 DA power take-off attachment.

O-6 tractors, serial numbers 7028 and up, all OS-6 and ODS-6 tractors use 67232 D standardized power take-off attachment.

I-6 and ID-6 tractors - All use 60428 D power take-off attachment.

Crawler tractors T-6 and TD-6 - may be equipped with one or two types of rear power take-off attachments. Attachment 53259 DA consists of a shaft extending into the drive bevel gear compartment and is driven from the rear end of the transmission upper spline shaft. The rear end of the power take-off shaft is an SAE 1-3/8 inch spline and is supported in a single row ball bearing cage-mounted in the center of the main frame. As the shaft is permanently coupled to the transmission upper spline shaft, it rotates at all times when the engine clutch is engaged. The speed of this attachment is 862 rpm at rated load engine speed of 1450 rpm (illust. 121A).

Number 58092 D reduced speed power take-off attachment consists basically of the same shaft and coupling as described above, plus a set of reduction gears and an in-and-out-of-gear coupling enclosed in a housing which attaches to the center of the rear main frame. The reduction gear shafts are all mounted in ball bearings. Lubrication is from a supply of lubricant in the attachment housing. Use the same grade of lubricant as specified for the transmission.

This attachment shaft is a standard SAE 1-3/8 inch spline and revolves at 540 rpm at the rated load engine speed of 1450 rpm. The engine clutch must be disengaged while shifting the power take-off shifter lever.

ATTACHMENTS AND SPECIAL FEATURES

FARMALL AND WHEEL TYPE TRACTORS

	M	MV	MD	MDV	W-6	WD-6	O-6	OS-6	ODS-6	I-6	ID-6
Air Pipe Extension	62973 D	62973 D	66754 D	66754 D	62973 D	66754 D	.....	.....	.....	.....	.....
Air Pre-Cleaner, Collector Type	59096 D	59096 D	59096 D	59096 D	59096 DA	59096 DA	.....	.....	.....	56096 DA	56096 DA
Belt Pulley	49265 DB	49265 DB	49265 DB	49265 DB	56313 D	56313 D	56313 D	56313 D	56313 D	56313 D	56313 D
Brakes, Hydraulic (H.D. Axle Only)	.....	.....	.....	.....	.....	.....	.....	.....	.....	65462 D	65462 D
Cultivator Shifter Lever	49194 DA	49194 DA	49194 DA	49194 DA	.....	.....	.....	.....	.....	.....	.....
Distillate Att. (30-44 Octane)	Std.	Std.	.....	.....	Std.	.....	Std.	Std.	.....	61572 DA	.....
Electric Starting and/or Lighting Equipt.	X	X	X	X	X	X	X	X	X	X	X
Exhaust Muffler	45804 DA	45804 DA	45804 DA	45804 DA	45804 DA	45804 DA	.....	.....	.....	45084 DA	45084 DA
Exhaust Pipe Extension	53556 D	53556 D	53556 D	53556 D	53556 D	53556 D	.....	.....	.....	53556 D	53556 D
Exhaust Spark Arrester	51579 D	51579 D	51579 D	51579 D	51579 D	51579 D	.....	.....	.....	51579 D	51579 D
Extension Tire (Rear)	49236 DB	.....	49236 DB	.....	60001 D	60001 D	.....	.....	.....	.....	.....
Extension Drum (Rear)	.....	.....	.....	.....	.....	.....	.....	.....	.....	X	X
Fenders, Rear	51499 DA	51499 DA	51499 DA	51499 DA	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Front Wheel Single, Steel	67879 D	.....	67879 D	.....	.....	.....	.....	.....	.....	.....	.....
Front Wheel Single, Pneu. 6.50X16	67878 D	.....	67878 D	.....	.....	.....	.....	.....	.....	.....	.....
Front Wheel Single, Pneu. 9.00X10	67880 D	.....	67880 D	.....	.....	.....	.....	.....	.....	.....	.....
Front Wheels, Variable Tread	52697 D	.....	52697 D	.....	.....	.....	.....	.....	.....	.....	.....
Front Wheels Steel Skid Ring 2-1/2"	53015 D	.....	53015 D	.....	53014 D	53014 D	.....	.....	.....	.....	.....
Front Wheel Weight 1st	48600 D	60197 D	48600 D	60197 D	48600 D	48600 D	.....	.....	.....	48600 D	48600 D
Front Wheel Weight 2nd	48602 D	60198 D	48602 D	60198 D	48602 D	48602 D	.....	.....	.....	48602 D	48602 D
Front Axle Adjustable, Wide Tread	57067 DB	.....	62027 DA	.....	.....	.....	.....	.....	.....	.....	.....
Front Axle, Heavy Duty	.....	.....	.....	.....	.....	.....	.....	.....	.....	64102 D	64102 D
Front Power Take-Off Coupling	.....	.....	.....	.....	.....	.....	.....	.....	.....	66865 D	66866 D
Gasoline Att. (70 Octane and Up)	58390 D	58390 D	.....	.....	58390 D	.....	58394 D	58394 D	.....	Std.	.....
Heat Indicator, Conventional Radiator	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB	49049 DB
Heat Indicator, Pressure Radiator	67135 D	67135 D	67135 D	67135 D	67135 D	67135 D	67135 D	67135 D	67135 D	67135 D	67135 D
Hour Meter (1450 R.P.M. Engine)	.....	.....	.....	.....	.....	51740 D	.....	.....	.....	.....	51740 D
Kerosene Att. (0 Octane)	58451 D	58451 D	.....	.....	58451 D	.....	58451 D	58451 D	.....	61578 DA	.....
Low-Boiling-Point Thermostat and Heat Indicator (Conventional Radiator)	64072 D	64072 D	64072 D	64072 D	64072 D	64072 D	64072 D	64072 D	64072 D	64072 D	64072 D
Pistons 5000 Foot Altitude	X	X	.....	.....	X	.....	X	X	.....	X	.....
Pistons 8000 Foot Altitude	X	X	.....	.....	X	.....	X	X	.....	X	.....
Power Lift, Hydraulic	15075 ECX	15075 ECX	15075 ECX	15075 ECX	.....	.....	.....	.....	.....	.....	.....
Selective Lift Control	POSP 6758	POSP 6758	POSP 6758	POSP 6758	.....	.....	.....	.....	.....	.....	.....
Power Take-Off Rear	X	X	X	X	X	X	X	X	X	X	X
Pneumatic Tire Pump	39622 D	39622 D	39622 D	39622 D	39622 D	39622 D	39622 D	39622 D	39622 D	39622 D	39622 D
Radiator Shutter	Std.	Std.	61718 DA	61718 DA	Std.	59226 DA	Std.	Std.	59226 DA	60892 DA	60920 DA
Rear Axle, Wide Tread 100"	52148 DA	52148 DA	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rear Axle, Heavy Duty	.....	.....	.....	.....	.....	.....	.....	.....	.....	64233 DB	64233 DB
Rear Wheel Dual Rim (Pneu.)	X	.....	X	.....	.....	.....	.....	.....	.....	X	X
Rear Wheel Overtire (Steel)	X	.....	X	.....	X	X	.....	.....	.....	.....	.....
Rear Wheel Overtire & Rim (Steel)	X	.....	X	.....	X	X	.....	.....	.....	.....	.....
Rear Wheel Weights 1st	49329 D	49329 D	49329 D	49329 D	64933 D	64933 D	51033 D	51033 D	51033 D	60806 D	60806 D
Rear Wheel Weights 2nd	49330 D	49330 D	49330 D	49330 D	60807 D	60807 D	51034 D	51034 D	51034 D	60807 D	60807 D
Rear Wheel Weights 3rd	49331 D	49331 D	49331 D	49331 D	60807 D	60807 D	51034 D	51034 D	51034 D	60807 D	60807 D
Reverse Flow Fan	68241 D	68241 D	68241 D	68241 D	68241 D	68241 D	68241 D	68241 D	68241 D	68241 D	68241 D
Speed Att: Low-Low	60216 D	.....	60216 D	.....	63413 D	63413 D	Std.	Std.	Std.	.....	.....
Speed Att. 7 M.P.H. Fourth	62400 D	.....	62400 D	.....	.....	.....	64788 D	64788 D	64788 D	.....	.....
Swinging Drawbar	49204 D	.....	49204 D	.....	52875 D	52875 D	Std.	Std.	Std.	.....	.....

ATTACHMENTS AND SPECIAL FEATURES

CRAWLER TRACTORS

Name	T-6	TD-6
Air Pipe Extension	58454 D	58454 D
Air Pre-Cleaner, Collector Type	59329 D	59329 D
Belt Pulley	x	x
Belt Pulley Drive Shaft	53259 DA	53259 DA
Cab	x	x
Crankcase Guard	52312 DA	52312 DA
Cutaway Sprocket	8774 D	8774 D
Distillate Att. (30-44 Octane)	Std.	.....
Electric Starting and/or Lighting Equip.	x	x
Exhaust Pipe Extension	53556 D	.....
Exhaust Muffler	45804 DA	45804 DA
Extended Track Frame	x	x
Front Bumper and Radiator Guard	52305 DA	52305 DA
Front Idler Shield	54000 D	54000 D
Front Power Take-off Coupling	53816 D	53826 D
Front Pull Hook	5961 DX	5961 DX
Gasoline Att. (70 Octane and Up)	58474 D	.....
Heavy Front Idler	9055 DX	9055 DX
Heavy Duty Track Roller Shield	58285 D	58285 D
High Hitch Drawbar	57219 D	57219 D
High Seat	54078 D	54078 D
Hood Side Doors	x	x
Hour Meter	.....	51740 D
Kerosene Att. (0 - Octane)	59285 D	.....
Low-Boiling-Point Thermostat and Heat Indicator		
Odometer	64072 D	64071 D
Orchard Fenders	x	x
Power Take-off, Rear	x	x
Power Take-off, Rear Reduced Speed	53259 DA	53259 DA
Radiator Shutter	58092 D	58092 D
Reverse Flow Fan	Std.	52300 D
Rigid Track Frame (Wide Tread)	66927 D	66927 D
Spark Arrester	59514 D	59514 D
Sprocket, Rock Deflector	51579 D	51579 D
	52054 D	52054 D

SPECIAL TRACK SHOES

~~T-6 AND TD-~~6 CRAWLER TRACTORS

Name	Type	Req.	Width	Attach.	Shoe
Street Plate	A	32	9½ in.	57517 D	29804 DB
Street Plate	A	64	9½ in.	57518 D	29804 DB
Skeleton Flat	B	64	9½ in.	57519 D	8773 D
Universal Flat	B	64	10 in.	57520 D	8772 D
Stagger Lug Ice Grouser and Snow Shoe:					
Center Lug Shoe	B	32	10 in.	57181 DA	57177 DA
End Lug Shoe	B	32	10 in.		57178 DA
Stagger Lug Ice Grouser and Snow Shoe:					
Center Lug Shoe	B	32	12 in.	57182 DA	57179 DA
End Lug Shoe	B	32	12 in.		57180 DA
Westco "Vee" Type Ice Grouser	A	64	10½ in.	57521 D	37820 D

(Continued on next page)

SPECIAL TRACK SHOES—Continued

T-6 AND TD-6 CRAWLER TRACTORS—Continued

Name	Type	Req.	Width	Attach.	Shoe
Detachable Ice Grouser:					
Straight Type	A	64	10 in.	57522 D	3271 DA
Inclined Type	A	64	10 in.	57523 D	5406 D
"V" Type	A	64	9½ in.	57524 D	3400 DA
Tee Type Inclined	C	64	9¼ in.	67246 D	67245 D

(A) Attach to Standard Rolled Section, Skeleton Flat, and Universal Flat Flat Shoes.
(B) Attach directly to Track Chain.
(C) Attach to Standard Rolled Section only.

ROLLED SECTION TRACK SHOES

Quantity and Size		Square Corner		Clipped Corner	
Used	Width	Attach.	Shoe	Attach.	Shoe
64	8 in.	53691 DB	53686 DB	53703 DB	53697 DB
64	10 in.	53692 DB	53242 DB	53704 DB	53698 DB
64	12 in.	53693 DB	53687 DB	53705 DB	53699 DB
64	*14 in.	57250 DB	57248 DB	57251 DB	57249 DB
64	*16 in.	53694 DB	53688 DB	53706 DB	53700 DB
64	*18 in.	53695 DB	53689 DB	53707 DB	53701 DB
64	*20 in.	53696 DB	53690 DB	53708 DB	53702 DB

* Wide Tread only.

ATTACHMENTS AND SPECIAL FEATURES

POWER UNITS

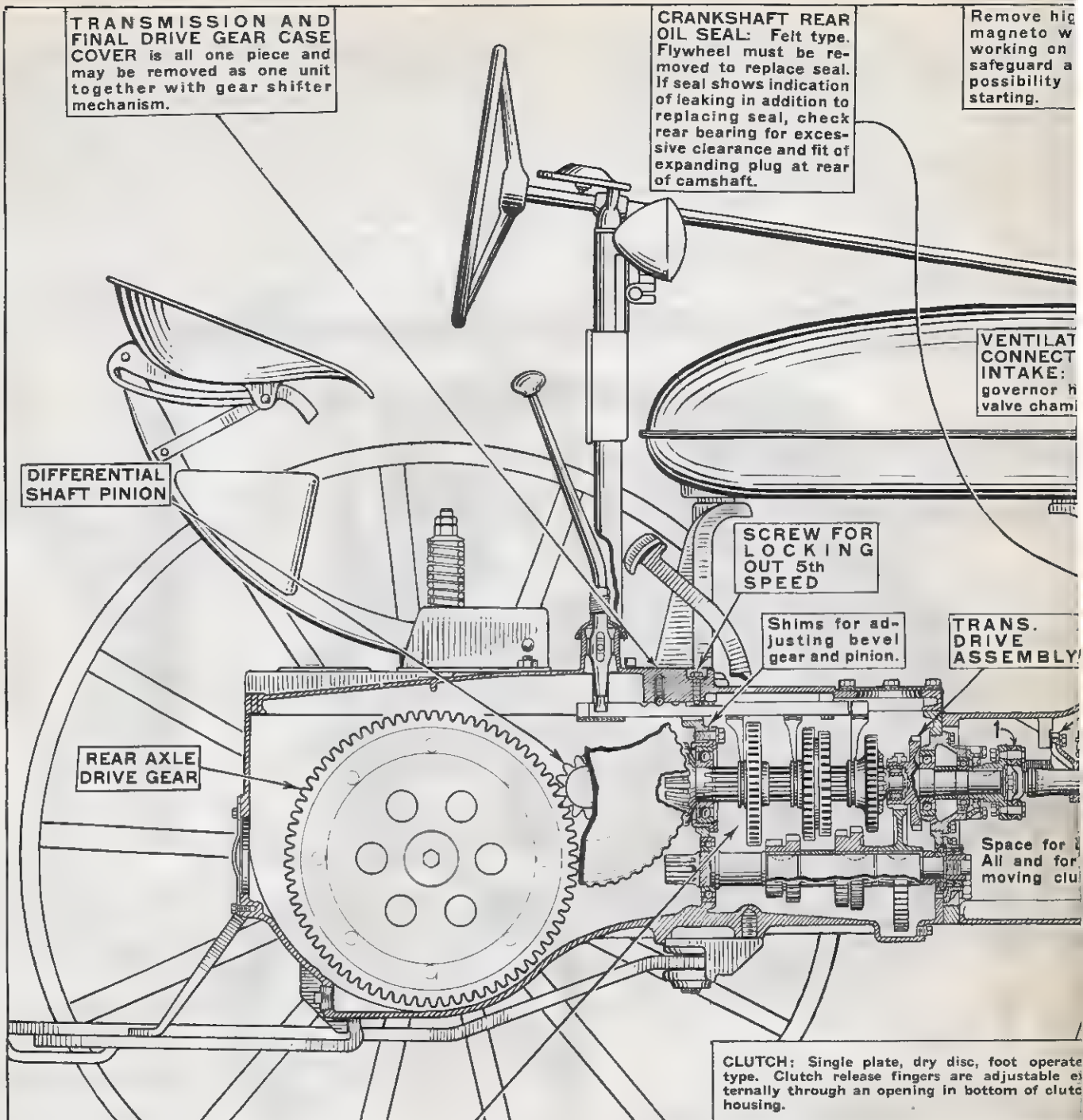
Name	U-6	UD-6
Automatic Oil Pressure and Water Temperature Cut-Out	60413 D	67810 D
Belt Pulley	x	x
Belt Tightener (for Slide Rails)	65200 D	65200 D
Combination Gas and Gasoline Burning Att.	59938 D	.....
Direct Connection Stub Shaft	57919 D	57919 D
Distillate Att. (30-44 Octane)	62135 D	.....
Electric Starting Equipment	x	x
Exhaust Muffler	45804 DA	45804 DA
Extended Pulley Shaft	60612 D	60612 D
Gas Burning Att. (Straight)	64116 D	.....
Gear Reduction	x	x
Hood Side Doors	57399 D	57903 D
Hour Meter - 1500 R.P.M. Eng.	.....	51740 D
Low-Boiling-Point Thermostat and Heat Indicator	64073 D	64072 D
Kerosene Att. (0 Octane)	59400 D	.....
Pistons - 5000 ft. Altitude	x	.....
8000 ft. Altitude	x	.....
Radiator Shutter	60827 D	60827 D
Reverse Flow Fan	66927 D	66927 D
Sub-Base (for Extended Shaft)	60636 D	60636 D
Slide Rail	61554 D	61554 D
Spring Loaded Clutch	60623 D	60623 D
Top Cylinder Oiler	59199 D	.....
Transmission (5 speed) with Spring Loaded Clutch	59222 D	59222 D
Twin Disc Power Take-Off	63165 D	63165 D

MEMORANDUM

MEMORANDUM

MEMORANDUM

Form CHS-87. 7-14-47—12B. PRINTED IN UNITED STATES OF AMERICA



TRANSMISSION: Gears and shafts can be removed from top of transmission after removal of transmission case cover and clutch shaft by following procedure as outlined.

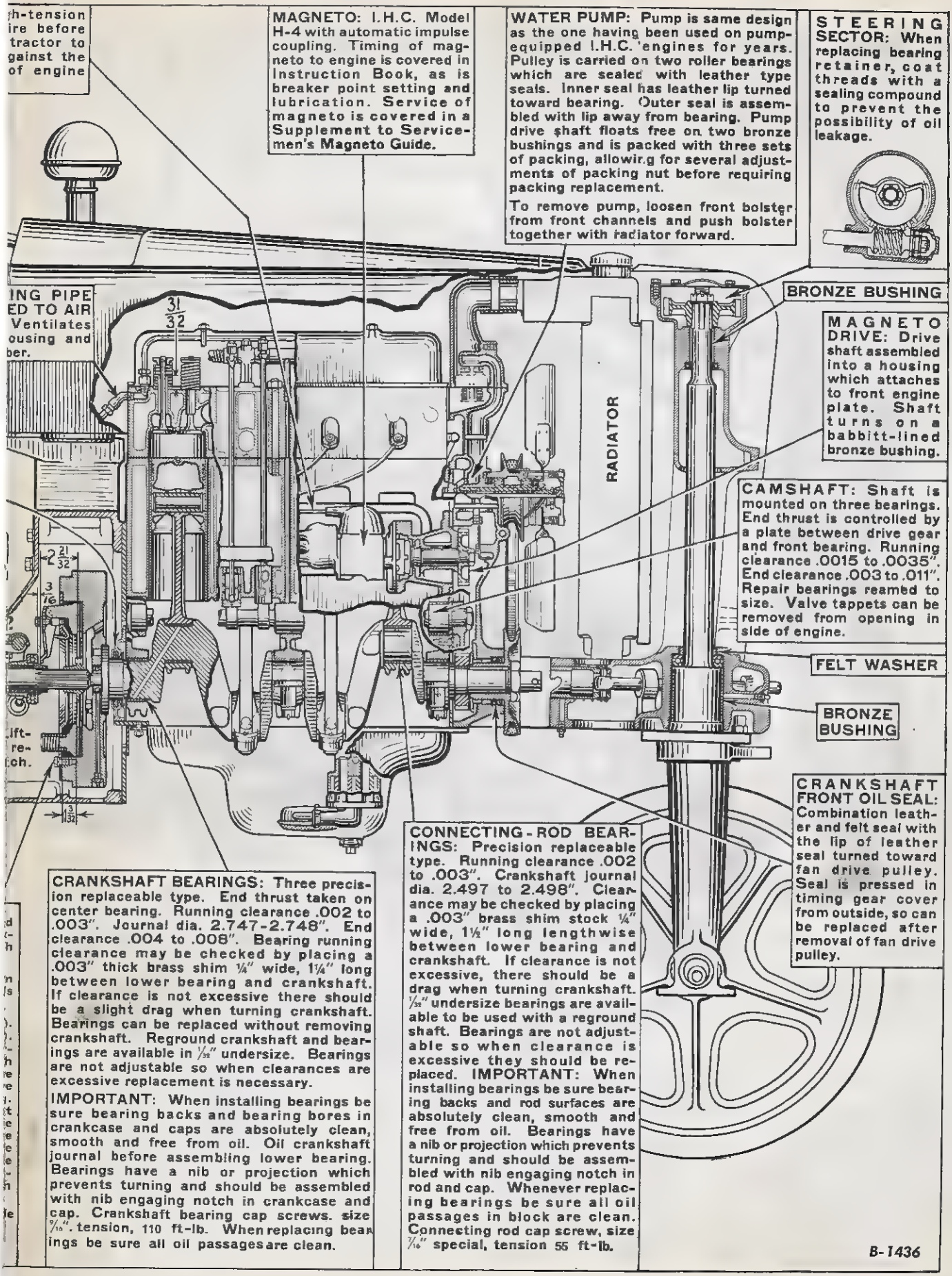
1. Pull transmission drive shaft coupling. 2. Remove transmission drive assembly. 3. Remove transmission main shaft (spline shaft with pinion). 4. Remove brake cross shaft. 5. Remove countershaft rear bearing snap-ring and drive out bearing with a brass bar. 6. Remove front countershaft nut, bearing retainer and drive countershaft back out of inner bearing race. 7. Drive front bearing out of case. 8. Push countershaft assembly back in transmission case and raise front end out. Assembly of transmission is made in the reverse manner.

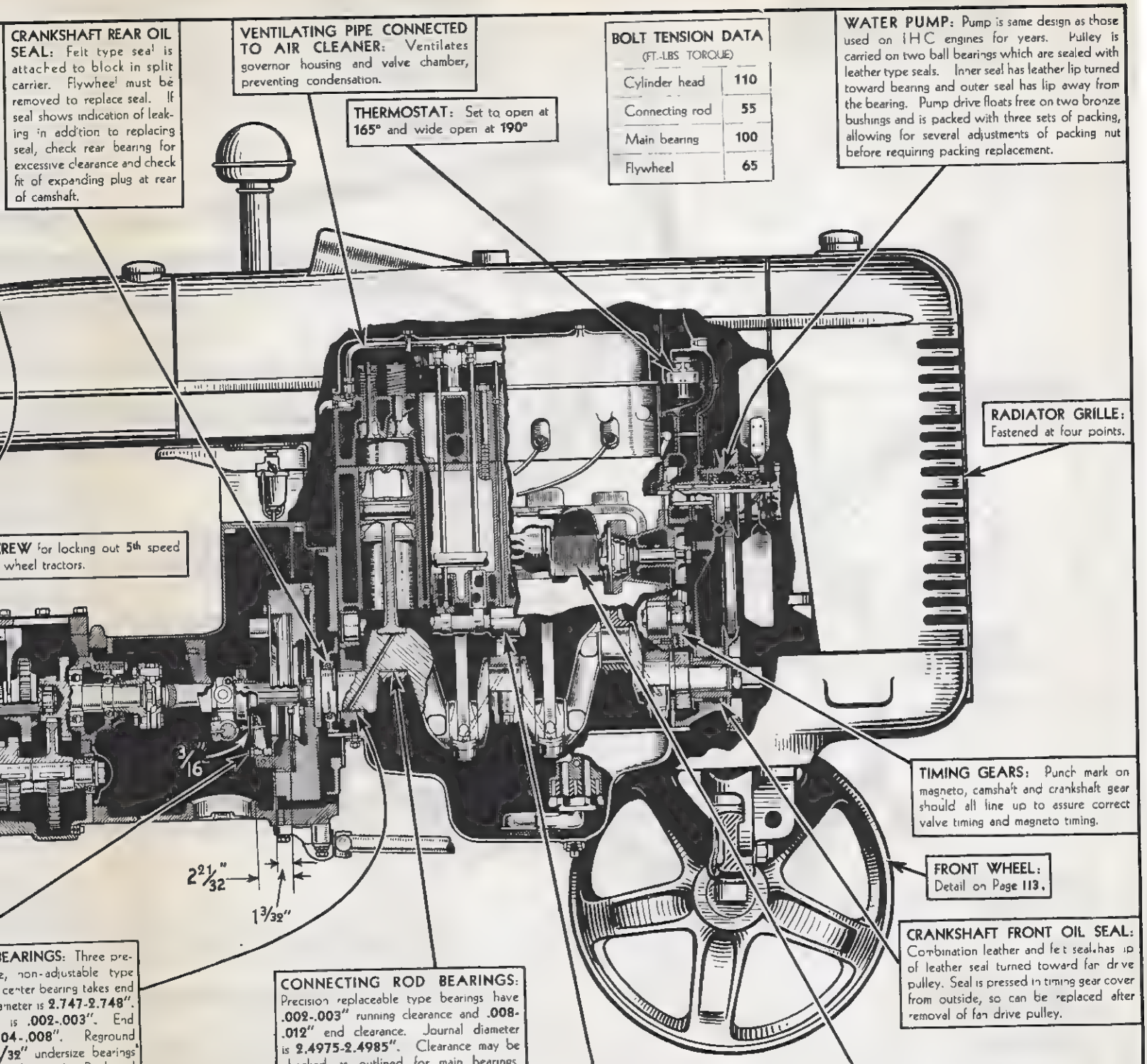
CLUTCH: Single plate, dry disc, foot operate type. Clutch release fingers are adjustable ex ternally through an opening in bottom of clutc housing.

Clutch is removable through an opening in botto of clutch housing. The procedure for removal as follows:

1. Remove four bolts from the clutch joint (1
2. Remove clutch release sleeve carrier (2
3. Remove clutch shaft together with thrust bea ing. 4. Remove three cap screws holding clutc to flywheel and after placing washers under th head of cap screws transpose them to the thre holes provided for compressing clutch spring 5. Remove the remaining cap screws and lift ou clutch. 6. Reassembly is made in the revers procedure, but be sure to install clutch shaft befor releasing pressure on clutch springs, and be sur to assemble clutch joint ring with convex sid toward clutch. Clutch is equipped with nine pres sure springs which should test 180 to 190 lb. whe compressed to 1 1/16".

For complete clutch service refer to service guid CHS-62.


h-tension
ire before
tractor to
gainst the
of engine
MAGNETO: I.H.C. Model H-4 with automatic impulse coupling. Timing of magneto to engine is covered in Instruction Book, as is breaker point setting and lubrication. Service of magneto is covered in a Supplement to Service-men's Magneto Guide.
WATER PUMP: Pump is same design as the one having been used on pump-equipped I.H.C. engines for years. Pulley is carried on two roller bearings which are sealed with leather type seals. Inner seal has leather lip turned toward bearing. Outer seal is assembled with lip away from bearing. Pump drive shaft floats free on two bronze bushings and is packed with three sets of packing, allowing for several adjustments of packing nut before requiring packing replacement.
To remove pump, loosen front bolster from front channels and push bolster together with radiator forward.
STEERING SECTOR: When replacing bearing retainer, coat threads with a sealing compound to prevent the possibility of oil leakage.
ING PIPE
ED TO AIR
Ventilates
ousing and
ber.
31/32
BRONZE BUSHING
MAGNETO DRIVE: Drive shaft assembled into a housing which attaches to front engine plate. Shaft turns on a babbitt-lined bronze bushing.
RADIATOR
CAMSHAFT: Shaft is mounted on three bearings. End thrust is controlled by a plate between drive gear and front bearing. Running clearance .0015 to .0035". End clearance .003 to .011". Repair bearings reamed to size. Valve tappets can be removed from opening in side of engine.
2 21/32
3/16
FELT WASHER
BRONZE BUSHING
lift-
re-
ch.
3/32
CRANKSHAFT FRONT OIL SEAL: Combination leather and felt seal with the lip of leather seal turned toward fan drive pulley. Seal is pressed in timing gear cover from outside, so can be replaced after removal of fan drive pulley.
CONNECTING-ROD BEARINGS: Precision replaceable type. Running clearance .002 to .003". Crankshaft journal dia. 2.497 to 2.498". Clearance may be checked by placing a .003" brass shim stock 1/4" wide, 1 1/2" long lengthwise between lower bearing and crankshaft. If clearance is not excessive, there should be a drag when turning crankshaft. 1/32" undersize bearings are available to be used with a reground shaft. Bearings are not adjustable so when clearance is excessive they should be replaced. IMPORTANT: When installing bearings be sure bearing backs and rod surfaces are absolutely clean, smooth and free from oil. Bearings have a nib or projection which prevents turning and should be assembled with nib engaging notch in rod and cap. Whenever replacing bearings be sure all oil passages in block are clean. Connecting rod cap screw, size 7/16" special, tension 55 ft-lb.
CRANKSHAFT BEARINGS: Three precision replaceable type. End thrust taken on center bearing. Running clearance .002 to .003". Journal dia. 2.747-2.748". End clearance .004 to .008". Bearing running clearance may be checked by placing a .003" thick brass shim 1/4" wide, 1 1/4" long between lower bearing and crankshaft. If clearance is not excessive there should be a slight drag when turning crankshaft. Bearings can be replaced without removing crankshaft. Reground crankshaft and bearings are available in 1/32" undersize. Bearings are not adjustable so when clearances are excessive replacement is necessary.
IMPORTANT: When installing bearings be sure bearing backs and bearing bores in crankcase and caps are absolutely clean, smooth and free from oil. Oil crankshaft journal before assembling lower bearing. Bearings have a nib or projection which prevents turning and should be assembled with nib engaging notch in crankcase and cap. Crankshaft bearing cap screws. size 7/16". tension, 110 ft-lb. When replacing bearings be sure all oil passages are clean.
B-1436



CRANKSHAFT REAR OIL SEAL: Felt type seal is attached to block in split carrier. Flywheel must be removed to replace seal. If seal shows indication of leaking in addition to replacing seal, check rear bearing for excessive clearance and check fit of expanding plug at rear of camshaft.

VENTILATING PIPE CONNECTED TO AIR CLEANER: Ventilates governor housing and valve chamber, preventing condensation.

THERMOSTAT: Set to open at **165°** and wide open at **190°**

BOLT TENSION DATA
(FT.-LBS TORQUE)

Cylinder head	110
Connecting rod	55
Main bearing	100
Flywheel	65

WATER PUMP: Pump is same design as those used on IHC engines for years. Pulley is carried on two ball bearings which are sealed with leather type seals. Inner seal has leather lip turned toward bearing and outer seal has lip away from the bearing. Pump drive floats free on two bronze bushings and is packed with three sets of packing, allowing for several adjustments of packing nut before requiring packing replacement.

RADIATOR GRILLE: Fastened at four points.

REW for locking out **5th** speed wheel tractors.

TIMING GEARS: Punch mark on magneto, camshaft and crankshaft gear should all line up to assure correct valve timing and magneto timing.

FRONT WHEEL: Detail on Page **113**.

CRANKSHAFT FRONT OIL SEAL: Combination leather and felt seal has lip of leather seal turned toward fan drive pulley. Seal is pressed in timing gear cover from outside, so can be replaced after removal of fan drive pulley.

EARINGS: Three pre-, non-adjustable type center bearing takes end meter is **2.747-2.748"**. is **.002-.003"**. End **04-.008"**. Reground **/32"** undersize bearings replacement. Rod and ance may be checked by brass shim **(1/4 x 1 1/4")** een lower bearing and ght drag on turning crank- factory clearance, replace arance is excessive. It is remove crankshaft to re- "T" shaped pin inserted rnal can be used to turn of crankcase. Be sure ngages notch in case and are **9/16"-12** and should th a torque wrench to on.

CONNECTING ROD BEARINGS: Precision replaceable type bearings have **.002-.003"** running clearance and **.008-.012"** end clearance. Journal diameter is **2.4975-2.4985"**. Clearance may be checked as outlined for main bearings. Bearings are not adjustable, so when clearance is excessive they should be replaced. For use with replacement undersize crankshaft, **1/32"** undersize bearings are available. When installing bearings, be sure bearing back and rod surfaces are absolutely clean, smooth and free from oil. Bearings have a nib or projection which prevents turning and should be assembled with nib engaging notch in rod and cap. Whenever replacing bearings, be sure all oil passages in rod and crankshaft are clean. Capscrews are **7/16"** and should be tightened with torque wrench to **55** Ft.-Lbs. tension.

CAMSHAFT: Shaft runs in three steel-back babbitt-lined bearings having **.0015-.0035"** running clearance. End clearance is **.003** to **.011"**. End thrust is taken on plate between helical drive gear and front bearing. Repair bushings are reamed to size and only need be pressed in place. Valve tappets can be removed through openings inside of crankcase. Valve lift is **7/16"**. When replacing drive gear be sure it runs true with front plate

MAGNETO: I.H.C. Model **H-4,** fixed spark, with automatic impulse coupling is flange-mounted to drive bracket. Drive shaft in bracket turns on babbitt-lined bronze bushings, lubricated from timing gear train. Remove high tension wire from top magneto cover before working on tractor to safeguard against possibility of engine starting. Spark occurs **35°** B.T.D.C. Impulse coupling releases on T.D.C. Time engine by making impulse coupling trip on T.D.C.; loosen cap screws on flange and tip top of magneto toward engine for retard and away for advance. Impulse coupling missing speed is **150** R.P.M.

B-2825

art 2. "6" Series Wheel Tractor

TRANSMISSION: To dismantle, remove gas tank, engine controls, steering gear, seat, transmission cover, clutch cover and clutch; then proceed as follows **1.** Remove transmission drive gear assembly as a unit (**6** cap screws) **2.** Take out rear bearing cage cap screws and pull out splined shaft and gears. **3.** Take out countershaft rear bearing snap ring and drive off bearing from inside with tool on inner race. **4.** Remove bearing retainer and retaining nut from front end of shaft and drive shaft out of front bearing. **5.** Take out countershaft. **6.** Remove front bearing from rear frame.

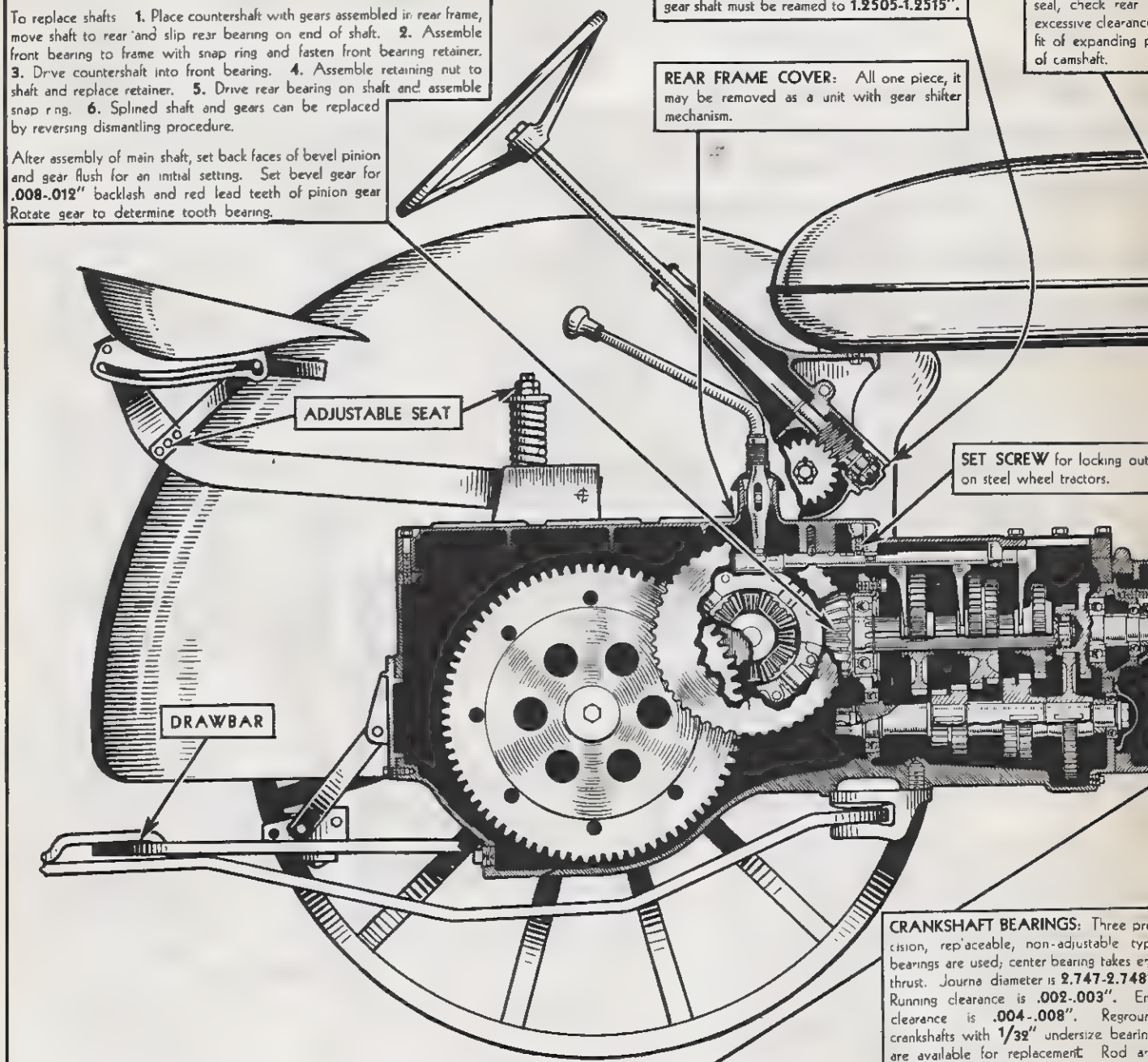
To replace shafts **1.** Place countershaft with gears assembled in rear frame, move shaft to rear and slip rear bearing on end of shaft. **2.** Assemble front bearing to frame with snap ring and fasten front bearing retainer. **3.** Drive countershaft into front bearing. **4.** Assemble retaining nut to shaft and replace retainer. **5.** Drive rear bearing on shaft and assemble snap ring. **6.** Splined shaft and gears can be replaced by reversing dismantling procedure.

After assembly of main shaft, set back faces of bevel pinion and gear flush for an initial setting. Set bevel gear for **.008-.012"** backlash and red lead teeth of pinion gear Rotate gear to determine tooth bearing.

STEERING GEAR: Worm and gear type mounted on bushing and ball bearings in housing on top of rear frame cover. Housing supports rear end of fuel tank and is held to cover with four bolts. Bushing for steering-worm shaft, for replacement, is reamed to size or **1.000-1.002"**. Two bushings for worm gear shaft must be reamed to **1.2505-1.2515".**

REAR FRAME COVER: All one piece, it may be removed as a unit with gear shifter mechanism.

CRANKSHAFT R
SEAL: Felt ty
attached to blo
carrier. Flywhee
removed to repla
seal shows indicat
ing in addition t
seal, check rear
excessive clearanc
fit of expanding p
of camshaft.



SET SCREW for locking out
on steel wheel tractors.

CRANKSHAFT BEARINGS: Three pr
cision, replaceable, non-adjustable typ
bearings are used; center bearing takes e
thrust. Journa diameter is **2.747-2.748**
Running clearance is **.002-.003"**. En
clearance is **.004-.008"**. Regroun
crankshafts with **1/32"** undersize bearin
are available for replacement. Rod a
main bearing clearance may be checked b
placing a **.003"** brass shim (**1/4 x 1 1/4"**
lengthwise between lower bearing a
crankshaft. A slight drag on turning cran
shaft indicates satisfactory clearance; replac
bearings when clearance is excessive. It
not necessary to remove crankshaft to r
place bearings. A "T" shaped pin insert
in oil hole of journal can be used to tu
upper shell out of crankcase. Be su
nib on bearing engages notch in case a
cap. Capscrews are **9/16"-12** and shou
be tightened with a torque wrench
100 Ft.-Lbs. tension

CLUTCH: Single plate, dry disc, foot-operated type is adjustable through opening in bottom of clutch housing of front frame. Clutch is removable through top of frame after removing gas tank, etc., bolts from clutch coupling, release sleeve carrier and clutch release fork. Take out clutch release shaft, and three cap screws from clutch. Reassemble cap screws into tapped holes in pressure plate and compress springs. Remove remaining cap screws, turn clutch shaft **90°**, slide shaft out of pilot bearing, move coupling down and lift clutch from housing. Reassemble by reversing above, but be sure to insert clutch in pilot bearing and attach clutch to flywheel before releasing pressure on springs. For complete service of clutch, refer to Service Guide, **CHS-62.**

Each of the nine pressure springs should test **180-190** lbs. at **1 13/16".** Distance between fingers and throwout bearing should be **3/16"** with clutch released.

PISTON: Selective fit to sleeve. Normal measured clearance at skirt given in engine specifications. Use 1/2" wide ribbon gauge. Piston assembled with indentation one pre-chamber side.

VALVE AND VALVE GUIDE: Clearance in guide is **.002** to **.004"**. Valve stem diameter is **.371** to **.372"**. Guide is assembled with chamfered end up. Service guides are furnished reamed to size. Guide bore and valve seat should be concentric within **.002"**. Valve seat width is **3/32"**.

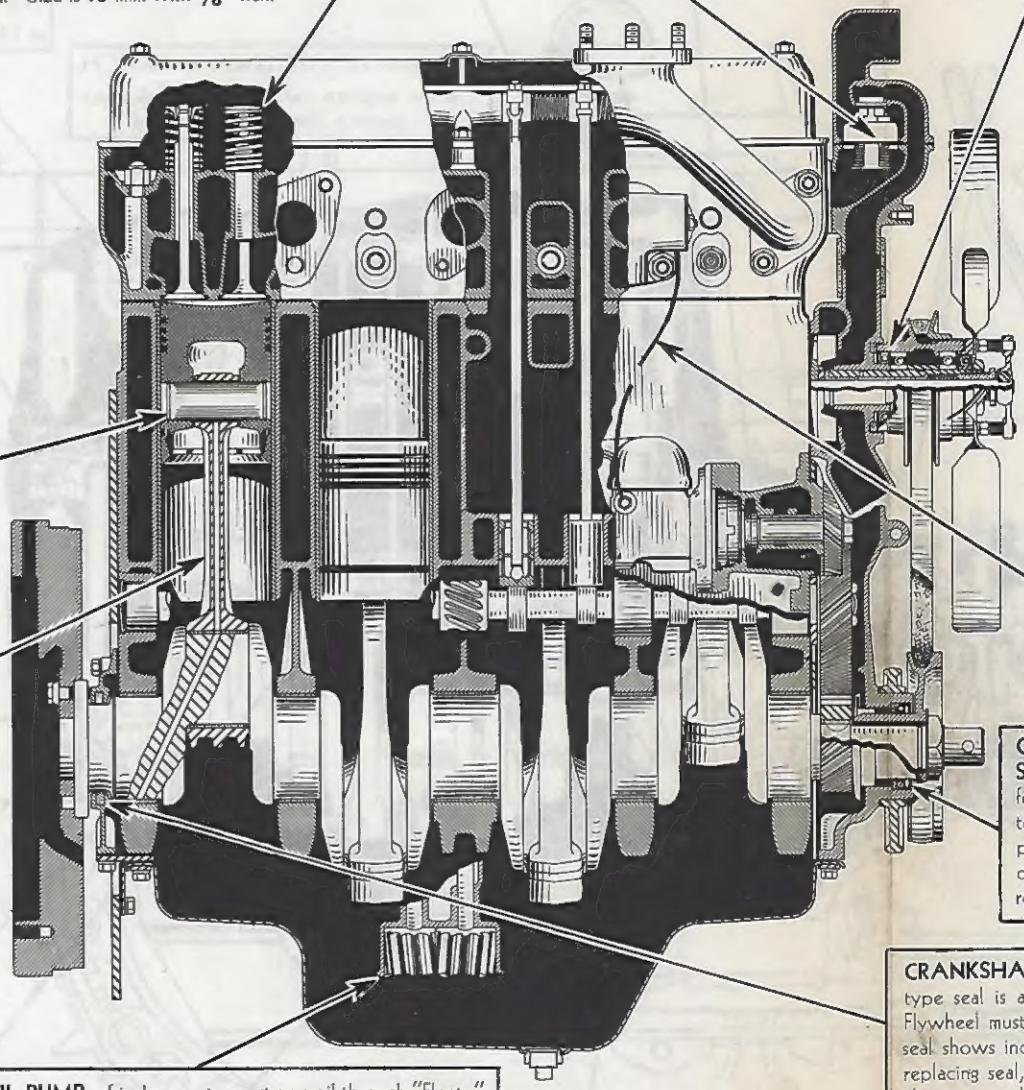
BOLT TENSION DATA (FT.-LBS. TORQUE)		
Cylinder head		110
Connecting rod		85
Main bearing	5/8"	125
	3/4"	150
Flywheel		65

SPARK PLUGS: Gap should be **.020** to **.025"**. When adjusting gap, bend only outside electrodes. Sandblasting is recommended method of cleaning. Size is **18** mm. with **7/8"** hex.

THERMOSTAT: Is set to open at **165°** and wide open at **190°**F.

PISTON RINGS: Three compression rings and two oil control rings; one oil ring is located below piston pin. Third compression ring from top of piston is tapered and should be assembled with the word "Top" toward top of piston. Fit rings to smallest section of sleeve bore in which ring travels. Ring gap is **.010-.020"**. Clearance in groove for top compression is **.004"**, all others are **.003"**. Ring grooves should be clean and free of carbon and oil holes in oil control groove drilled out. Stagger ring gaps around pistons; dip piston in oil before installing in sleeve.

PISTON PIN: Pin floats in rod and piston; it is held in by two snap spring retainers. Clearance in rod bushing is **.0003-.0005"**, and in piston is **.0001-.0003"**. Pin diameter is **1.3125-1.3128"**. Heat piston when removing or replacing pin. Oversize pin **(+.005")** is available.



CONNECTING ROD: Assemble piston to rod with indented side of piston opposite from stamped markings on rod, then assemble rod and piston to engine with number markings on rod and cap toward camshaft side of engine. Cylinder numbering starts at front of motor. Remove and replace piston and rod assembly from top of engine. Rod should be straight and free from twist.

CONNECTING-ROD BEARINGS: Precision replaceable type bearings have **.0023-.0033"** running clearance and rods have **.003-.010"** end clearance. Journal diameter is **3.2480-3.2485"**. Running clearance may be checked as outlined for main bearings. Bearings are not adjustable, so when clearance is excessive they should be replaced. For use with replacement undersize crankshaft, **1/32"** undersize bearings are available. When installing bearings, be sure bearing back and rod surfaces are absolutely clean, smooth and free from oil. Bearings have a nib or projection which prevents turning and should be assembled with nib engaging notch in rod and cap. Whenever replacing bearings, be sure all oil passages in rod and crankshaft are clean. Capscrews are **1/2"** and should be tightened with torque tension wrench to **85** ft.-lbs. tension.

OIL PUMP: Single gear type, draws oil through "Floato" oil screen and pumps oil to main, connecting-rod and camshaft bearings, timing gears, piston pins and valve mechanism. Drive pinion is keyed and pinned to shaft and so is drive gear. Oil pressure regulating valve in purolator base maintains **60** to **70** lbs. pressure at **1450** R.P.M.

CAMSHAFT BEARINGS: 4 steel-backed, babbitt-lined bearings are used, being pressed in place and then line-reamed to size. Replacement bearings, however, are furnished reamed to size; they need only be pressed in place. Running clearance is **.0015-.0035"**; end clearance is **.002-.010"**. End thrust is taken on bronze plate between helical drive gear and front bearing.

CRANKSHAFT BEARINGS: Five p
flange of center bearing takes end thrust
.0027-.0037". End clearance is **.00**
are available for replacement. Rod and
brass shim **(1/4 x 1 1/4")** lengthwise bet
turning crankshaft indicates satisfactory c
necessary to remove crankshaft to repla
can be used to turn upper shell out o
cap. Bearing cap nuts are **5/8" (8)**
wrench to **125** and **150** ft.-lbs. tension,

CRANKSHAFT RE
type seal is attache
Flywheel must be re
seal shows indicatio
replacing seal, check
clearance and check
rear of camshaft.

CRAN
SEAL:
felt seal
toward
pressed
outside
removal

GR
Fron
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Chart 5. "6" Series Diesel Engi

NSION DATA

(S. TORQUE)

ead		110
rod		85
ng	5/8"	125
	3/4"	150
		65

WATER PUMP: Pump is same design as those used on IHC engines for years. Pulley is carried on two ball bearings which are sealed with leather-type seals. Lips of both leather seals face the radiator. Pump drive floats free on two bronze bushings and has a packing that allows for ample adjustments of packing nut before requiring packing replacement. Tighten nut only sufficiently to stop leaking. Complete service is covered in discussion. Rotate forward flange to adjust belt tension.

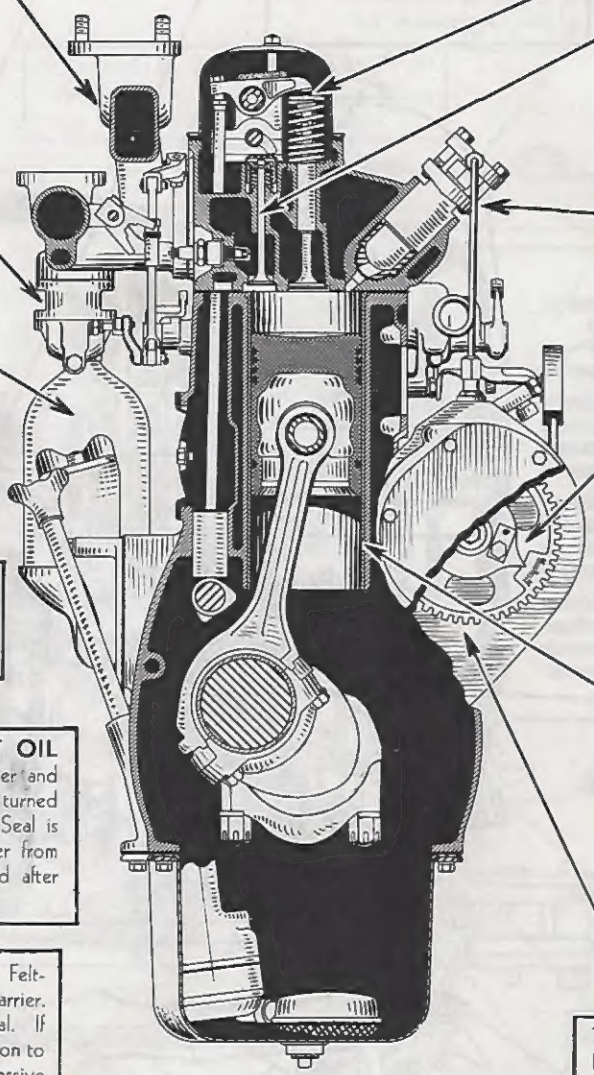
VALVE ADJUSTMENT: Clearance between rocker-arm and valve stem is **.017"** with engine hot. Recheck after tightening rocker-arm assembly or cylinder head. Rocker-arm bushings can be replaced and reamed to size; oil holes in bushing must line up with oil holes in levers. Clean out oil holes to wick and adjusting screw after reaming. Running clearance is **.002-.004"**; valve lever shaft is **.872-.873"** diameter.

EXHAUST MANIFOLD

VALVE SPRING: Should test **48-54** lb. at **2 1/16"**; free length is **2 13/32"**.

STARTING VALVE: Spring retainer assembled same as conventional valve. Valve cover should be free to slide up and down in bore in cylinder head. Gap between cover and cam or cam roller is **.060** to **.080"**. Valve seat width is **3/64"**.

STARTING CARBURETOR: Fuel level is **13/32** to **7/16"** below top of bowl. Air valve should be **3/32** to **7/64"** open.



INJECTION NOZZLE: Remove by taking out two capscrews. Assembly should be clean and free of carbon. Valve should open at **700** pounds pressure. Bleed air from nozzle after cleaning fuel filter.

INJECTION PUMP DRIVE GEAR: Time pump (with front cover in place) by lining up notch on pump drive hub with notch on drive gear hub when engine is on compression stroke for No. 1, T.D.C. Place timing indicator on hub with pointer at zero mark on gear. Bolt hub, gear and indicator together; pump is retimed. Shift pointer to obtain maximum speed for a given load with the cleanest exhaust. Clockwise shift of pointer advances injection.

OIL FILTER: Element should be replaced every time oil is changed or oftener, if need be.

GROUND WIRE: From magneto to automatic grounding switch in manifold.

CYLINDER SLEEVE: Dry-liner-type sleeves can be removed and replaced same as wet-type sleeves, requiring no honing or boring after assembly. Standard replacement piston and sleeve sets are available for repairs. Puller **SE-1213** is available for removal of sleeves. Coat outside of sleeve with light film of oil for ease of assembly. Wooden block held firmly across top of sleeve should be used when tapping sleeve into bore. Top of sleeve is **.041-.047"** above surface of crankcase when assembled.

CRANKSHAFT FRONT OIL SEAL: Combination leather and felt seal has lip of leather seal turned toward fan drive pulley. Seal is pressed in timing gear cover from outside, so can be replaced after removal of fan drive pulley.

CRANKSHAFT REAR OIL SEAL: Felt-type seal is attached to block in split carrier. Flywheel must be removed to replace seal. If seal shows indication of leaking, in addition to replacing seal, check rear bearing for excessive clearance and check fit of expanding plug at rear of camshaft.

TIMING GEARS: Gears are all punch-marked to facilitate correct assembly. Idler gear drives camshaft and injection pump gears.

BEARINGS: Five precision, replaceable, non-adjustable type bearings are used; ring takes end thrust. Journal diameter is **3.7480-3.7485"**. Running clearance is nd clearance is **.004-.008"**. Reground crankshafts with **1/32"** undersize bearings placement. Rod and main bearing clearance may be checked by placing a **.003"** 1/4") lengthwise between lower bearing and crankshaft journal. A slight drag on dicates satisfactory clearance; replace bearings when clearance is excessive. It is not e crankshaft to replace bearings. A **"T"** shaped pin inserted in oil hole of journal n upper shell out of crankcase. Be sure nib on bearing engages notch in case and nuts are **5/8" (8)** and **3/4" (2)** and should be tightened with a torque tension **150** ft.-lbs. tension, respectively.

MAGNETO: I.H.C. Model H-4, fixed-spark, with automatic impulse coupling is flange-mounted to drive bracket. Drive shaft in bracket turns on babbitt-lined bronze bushings, lubricated from timing gear train. Remove high-tension wire from top of magneto cover before working on tractor to safeguard against possibility of engine starting. Impulse coupling releases **13°** after T.D.C. Time engine by making impulse coupling trip **1/2** to **1"** past T.D.C. as measured from **"DC"** mark on water pump drive pulley to timing indicator in front cover. Loosen capscrews on flange and tip top of magneto away from engine for retard of spark. Impulse coupling missing speed is **150** R.P.M.

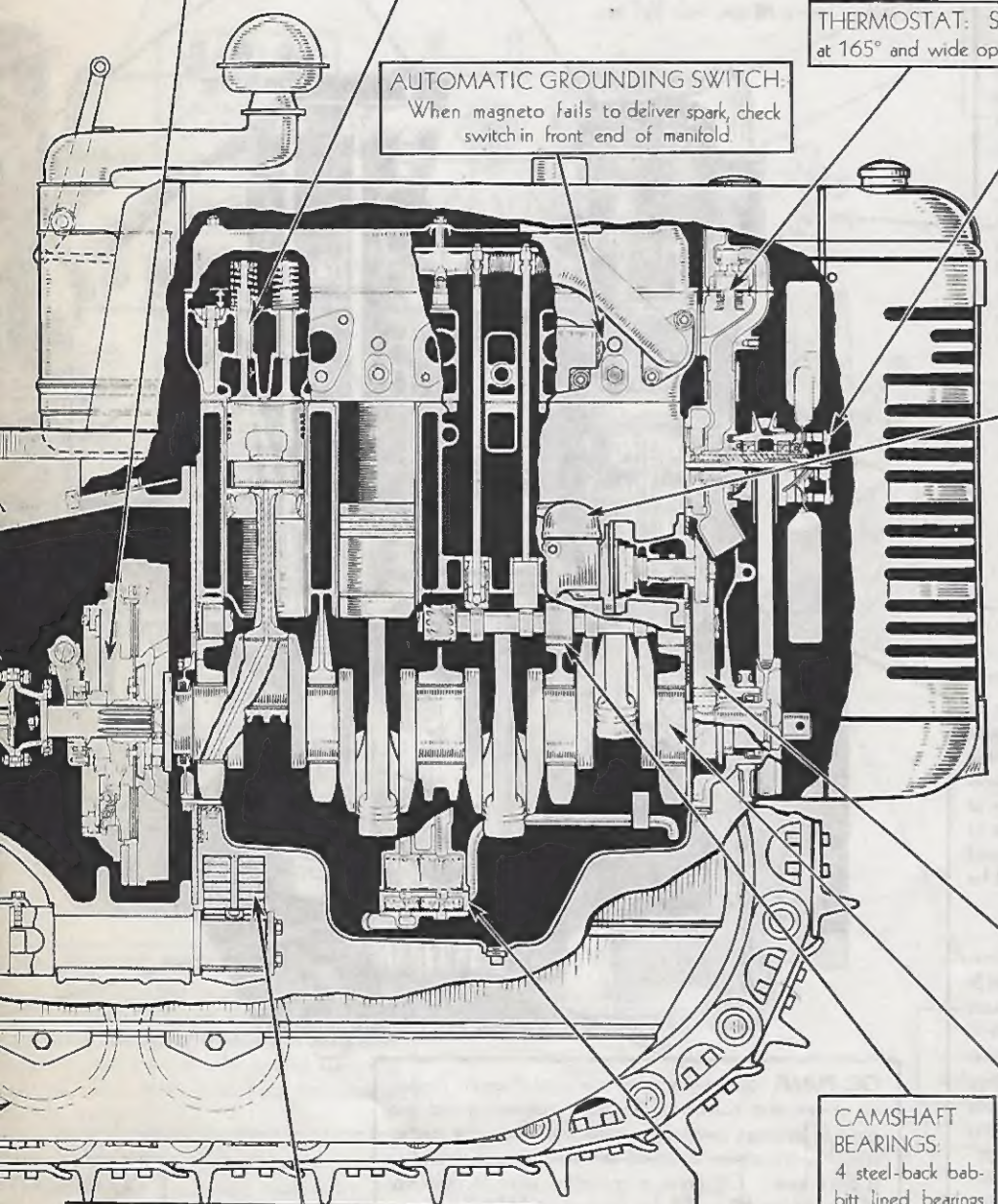
NGINE CLUTCH: To remove, take off spection cover and clutch cover, remove lts from clutch coupling, turn shaft, lift out upling, take out grease fitting in clutch shaft move release shaft, release fork, and release llar pin bushings, take out capscrews hold- g clutch to flywheel, pry clutch shaft out of lot bearing, and lift clutch out of main frame.

VALVE AND VALVE GUIDE
Clearance between valve stem and guide is .002" to .004". Replaceable valve guides are furnished to size. Press guide in place with sharp chamfered end up Guide bore and valve seat should be concentric within .002"

WATER PUMP: Remove water pump driver and take out packing gland with wrench 11858-DA, to add packing to the pump. Only tighten packing the amount required to stop any leaking. Pump can be removed after taking off fan housing sheet, leaning it against engine, removing fan, hose connections and bolts holding unit to the crankcase. Bushings in pump are replaceable and are furnished reamed to size. Lips of leather seals face the radiator.

THERMOSTAT: Set to open at 165° and wide open at 190°.

AUTOMATIC GROUNDING SWITCH: When magneto fails to deliver spark, check switch in front end of manifold



MAGNETO: IHC Model H-4 with automatic impulse coupling is flange mounted to drive bracket. Impulse coupling missing speed is 150 r.p.m. To time magneto, set engine on TDC for No. 1 cylinder on compression stroke. Continue cranking until letter "M" on forward flange of fan drive pulley lines up with pointer in crankcase front cover. With distributor arm in magneto pointing to No. 1 spark plug wire socket in distributor cap, turn top of magneto away from engine as far as bolts will allow (retard direction). Then move top of magneto toward engine (advance direction) until impulse coupling trips. Lock in this position. To recheck timing, crank engine. Impulse coupling should trip just as "M" mark lines up with pointer. Start engine and while operating on gasoline, move magneto to a position that gives the clearest and sharpest exhaust. Be sure no fuel oil is being injected while operating on gasoline. Breaker point gap .013".

TIMING GEARS: Gears are all punch marked to facilitate correct assembly. With front cover removed, take out idler gear, line up magneto and camshaft gear, turn crankshaft to T.D.C. for No. 1 cylinder on compression stroke, hold idler gear in position lined up with crankshaft pinion, line up pump and camshaft gear, push in place, and fasten idler shaft.

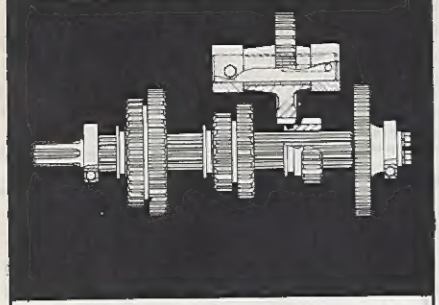
CAMSHAFT BEARINGS: 4 steel-back babbitt lined bearings are available reamed to size and need only be pressed in place. Running clearance is .0015" to .0035", end clearance is .002" to .010"

MAIN BEARINGS: Five precision, replaceable, nonadjustable type bearings are used, flanges of center bearing take end thrust of crankshaft. Journal diameter is 3.7480" to 3.7485" on TD-6; running clearance is .0027" to .0037", end clearance at center bearing is .004" to .008" Nuts holding bearing caps to crankcase should be tightened to 150 ft-lb. torque. Nuts (⅞") on center main bearing should be tightened to 125 ft-lb. torque. Move equalizer spring on rigid frame forward to make capscrews in rear of oil pan acces sible.

oved o the bolts s and need track

EQUALIZER SPRING: To remove, jack up front of tractor at radiator, remove capscrews from front end of equalizer spring pivot shaft, remove capscrews holding pivot shaft cap to bottom of main frame, push shaft and drawbar to the rear as far as possible, slide spring to one side to free opposite end, and pull forward. Steel bushings in spring saddle can be replaced, they are furnished finished to size.

OIL PUMP: Two capscrews hold pump to crankcase and one holds pipe for auxiliary pump.



TRANSMISSION: To remove, clear top of main frame including seat, remove engine clutch and transmission front cover, take out capscrews in bearing retainers at rear of transmission, and pull out both upper and lower shafts. Idler shaft on side of main frame can be removed after taking out retaining bolt and driving idler shaft from main frame. Gears can be slid off top shaft. Gears can be removed from lower shaft after pulling bearing and removing retaining nut.

When reassembling, the above procedure can be reversed.

STEERING CLUTCH ADJUSTER: To obtain 4" free travel of hand lever, turn the turnbuckle. Shorten linkage to increase free travel. Move release lever on release fork for additional adjustment.

GEAR SHIFT HOUSING: To remove, take out seat cushion, front seat member, steering clutch lever springs, turnbuckle assembly, and capscrews and dowel pins from housing. Stop screw on top of housing, limits forward travel of steering clutch hand levers

ENGINE C
inspection co
bolts from cl
coupling, tak
remove relea
collar pin bu
ing clutch to
pilot bearing

POWER TAKE-OFF: Shaft attaches to rear end of upper splined shaft. Bearing in bearing cage at rear of main frame supports shaft.

RELEASE FORK: Remove by taking off attaching parts on top of main frame cover, remove main frame cover, take out pivot from bottom of main frame, and lift out release fork. When replacing, adjust pivot for equal space above and below release collar pin bushings. Fork should turn freely, before and after tightening capscrews on release bearing in main frame cover.

DIAGONAL BRACE CLAMP: Remove capscrews in clamp to gain access to shims or as a part of removal procedure for track frames. Bearings can be removed with diagonal brace in position.

TRACK FRAMES: To remove, jack up front end of tractor, remove track chain, take off stabilizer roller guide, take out bolts in diagonal brace clamp at pivot bearing, support rear of tractor at drawbar, take off sprocket shield, remove bolts from pivot bracket cap and bracket, and pull frame to the side to clear equalizer spring. Equalizer spring may be removed, if so desired, as well as diagonal brace where it bolts to the track spring guide. Track frame can then be rolled forward on track.

TRANSMISSION END COVER. Can be removed after taking out engine clutch, and cap and retainer from upper shaft, remove set screws from tapped holes, and use $\frac{3}{8}$"—16 capscrews to pull cover assembly.

TRACK ROLLERS: Welded construction steel rollers can be removed after taking off track chain, jacking up end of track frame closest to the roller to be removed, removing track roller shields, and taking out bolts holding brackets to the track frame. Snap rings retain thrust washers and shaft in track rollers. Bushings reamed to size are obtainable and need only be pressed in place. Lips of double leather oil seals face the track roller brackets.